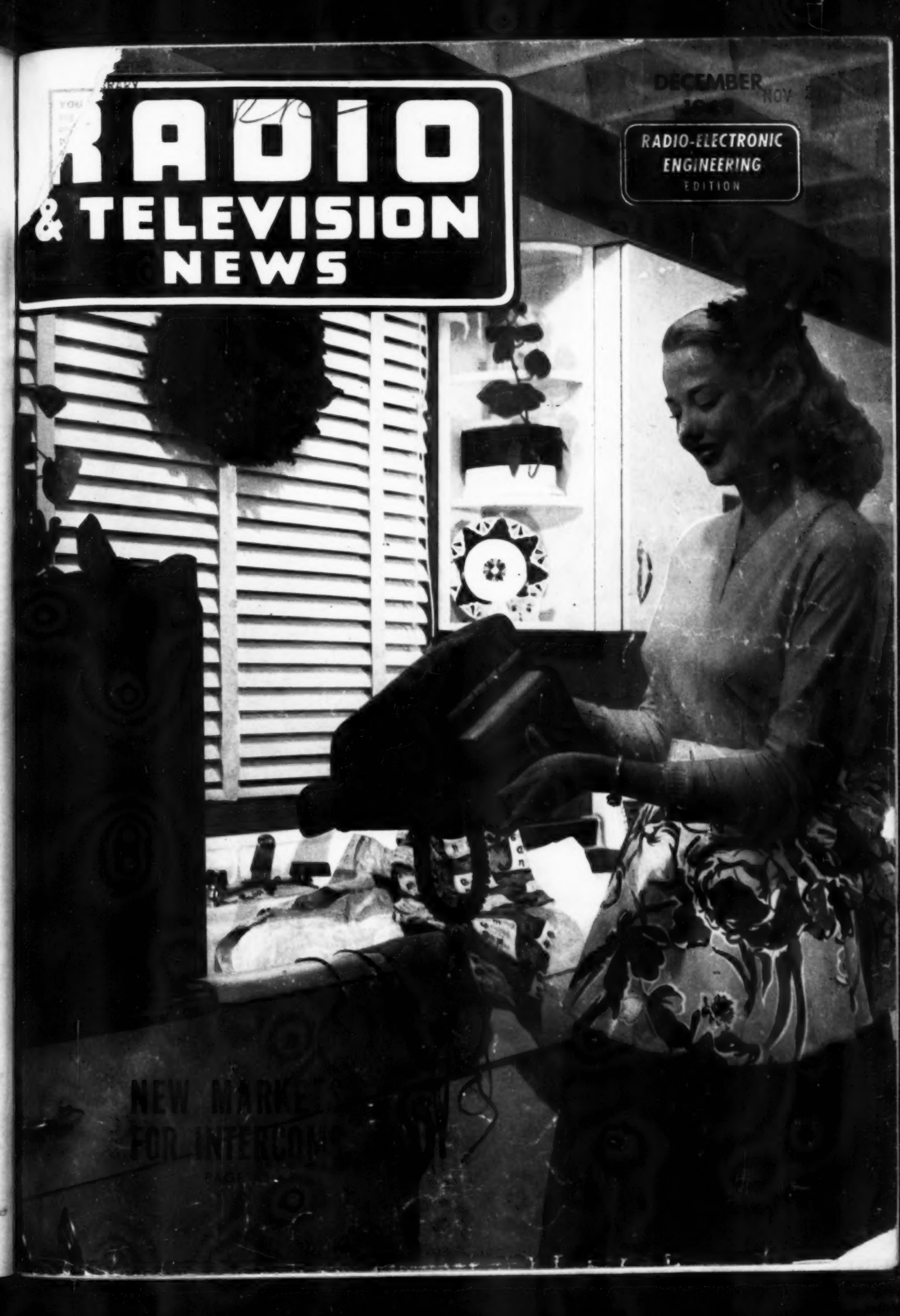

RADIO
& TELEVISION
NEWS
DECEMBER
RADIO-ELECTRONIC
ENGINEERING
EDITION
NEW MARKET
FOR INTERCOM

VIDEO

6AG5 6J6 6AL5 6AU6

AUDIO

6BA6

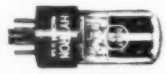
6AU6

6AL5

6K6GT

FRONT END to PICTURE TUBE

SWEEP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6W4GT

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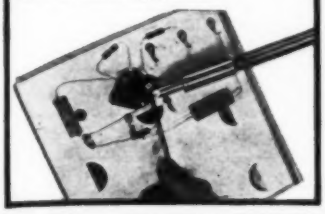
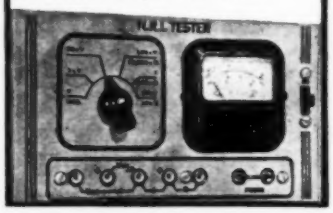
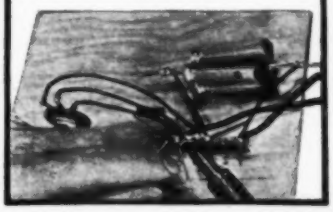


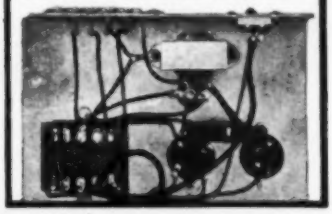
YOU BUILD this Tester with parts N.R.I. sends early in the course. Soon helps you fix neighbors' Radios and EARN EXTRA MONEY in spare time.



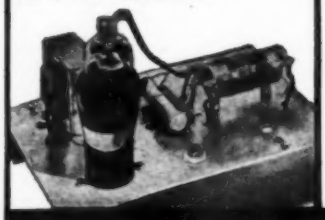
YOU TEST Radio circuits like this built with parts I send. Build special circuits; learn how to locate and repair circuit defects.



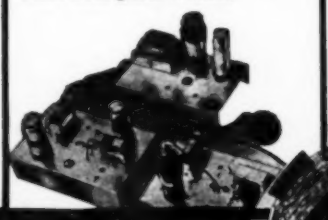
YOU BUILD Vacuum Tube Power Pack; make changes which give you experience with packs of many kinds. Learn how to correct Power Pack troubles.



YOU BUILD this AM Signal Generator for more valuable experience. It provides amplitude-modulated signals for many tests and experiments.



YOU PRACTICE FM (Frequency Modulation) experiments, get more experience with this Superheterodyne Receiver Circuit you build with parts I send.



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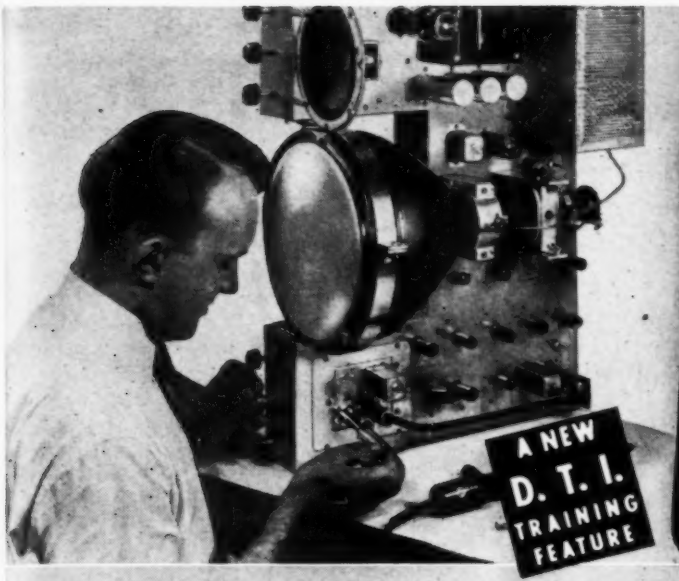

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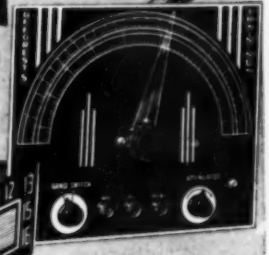

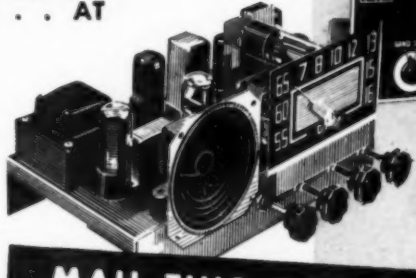

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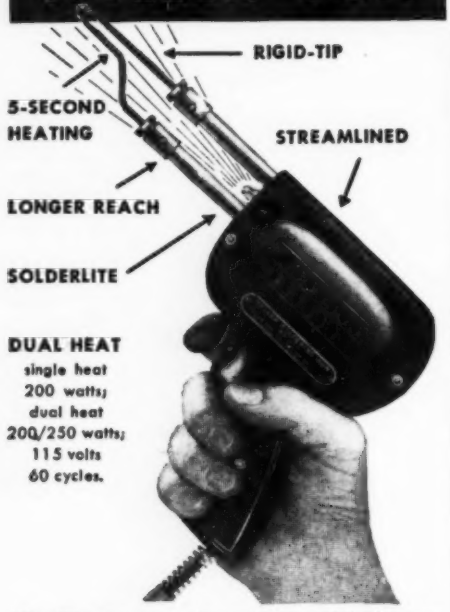

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For the RECORD

BY THE EDITOR

YOUTH EAGERLY AWAITS NOVICE LICENSE

THE new proposed "Novice Class" of amateur radio license, brings to fruition a campaign started in the Spring of 1946 by RADIO & TELEVISION NEWS, when it made a proposal to the Amateur Radio Committee of RMA for "launching a campaign for 'New Ham Blood' in the interest of teenagers, returning Vets, and Communication-minded Scouts." Such a campaign, we felt, would help stabilize the average age limit of the active ham, which at that time had risen to an average of 34 years.

This Committee, including members of ARRL, failed to function and disappeared from further activity.

In an editorial (page 8, Sept. 1948) we took issue with this lack of any activity to encourage youth in ham radio, and pointed to the danger of ignoring "new blood."

George Bailey (President of the ARRL) apparently in accord with our thinking, stressed the need for "new amateur blood" during his talk in Milwaukee, during the 1948 ARRL Convention.

Right on the heels of Mr. Bailey's talk, came an editorial, in "Zero Bias" published in *CQ* magazine, that further cited the need for more and younger amateurs.

But *QST* remained silent, even though its staff could certainly visualize the importance of augmenting our hobby with some encouragement to the newcomer, but—no comment!

It was then decided to launch a $10,000.00 New Ham Contest (Jan. 1949, page 8) to encourage the training of new ham blood and to increase the numerical strength of Amateur Radio. George Bailey himself, in an unsolicited letter, congratulated us for our efforts on behalf of youth seeking a stimulus to get into amateur radio.

In addition, we started a new series of articles, "The Beginning Amateur" to help the newcomer. This series was most popular and did serve its purpose. Literally hundreds of youngsters, and oldsters too, have followed this series with keen anticipation of the day when they could qualify for their ham licenses. (We still have reprints for prospective newcomers.)

We learned from frequent visits to Washington that amateurs in general were taking too much for granted in the matter of their welfare. It was then and there decided to point to this dangerous thinking in our editorial of May of this year, followed by a mailing of the editorial to all licensed hams.

If the campaign, as carried out by RADIO & TELEVISION NEWS, has in any way influenced the FCC to propose a Novice Class of license then we are eternally grateful for the recognition given to the vital need for encouraging youth to join with the old-timers for a better fraternity of amateur radio. To SARA, NARC, FCC and now ARRL (see page 54) go our thanks for their wisdom in proposing the Novice and Technician's Class of license.

Surely October 1949 will go on record as the historic month which resulted in "Solidarity" for the American Radio Amateur.

The ARRL will, as a result, win greater respect from the amateur fraternity.

New Ham Contest Nears Close

There is still time for individuals to train potential hams for their licenses and meet the deadline of midnight, March 1, 1950. If the new FCC rules and regulations (Docket 9295) are put into effect in the near future, and we believe they will be, (including some modifications proposed by ARRL, SARA, and NARC) there will be ample time for literally hundreds of prospects to qualify for the new "Novice" or "Technician's Class" of license.

The official rules of the contest (page 67, May 1949, RADIO & TELEVISION NEWS), do not specify any particular class of amateur operator or station license. Therefore, any new FCC regulations that result in additional classifications in effect at the close of the contest must be considered as long as the newly licensed trainees have received call letters.

It is too early to predict possible winners of the 126 awards. There is, according to current status, plenty of opportunity for many more to hit the jackpot and win one of many valuable awards.

This may be the long awaited opportunity to qualify some of the laggards who have been encountering trouble learning the code. With the simplified theory and code requirements, we do know that many of these heretofore "impossibles" can now come through with flying colors . . O.R.

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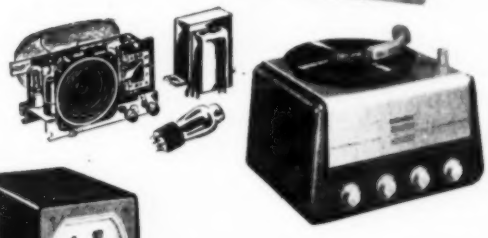

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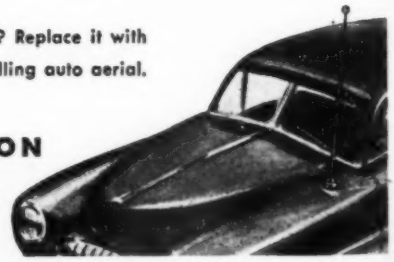

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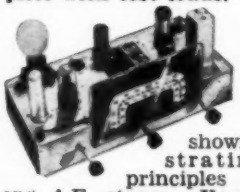
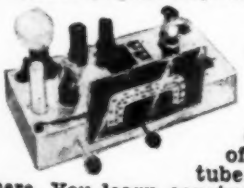


SIGNAL GENERATOR

You construct the Transitron Signal Generator shown here, demonstrating Transitron principles in both R.F. and A.F. stages. You study negative type oscillators at firsthand.

AUDIO OSCILLATOR: An electronic device, which produces audio-frequency signals for modulating R.F. (radio frequency) carrier waves, testing A.F. (audio frequency) amplifiers, speakers, etc.



T.R.F. RECEIVER

You build several T.R.F. Receivers, one of which, a 4-tube set, is shown here. You learn construction, alignment, make receiver tests, and do trouble shooting.

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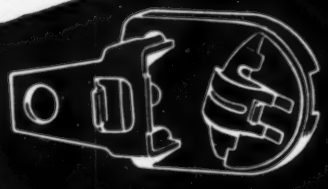

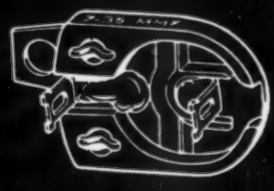

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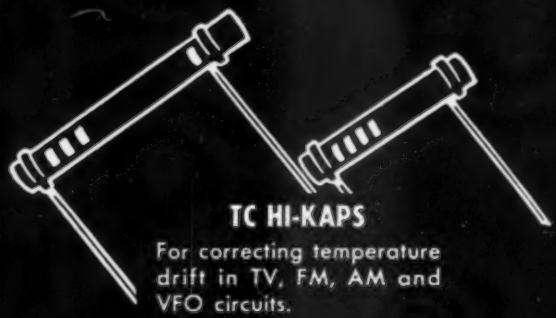

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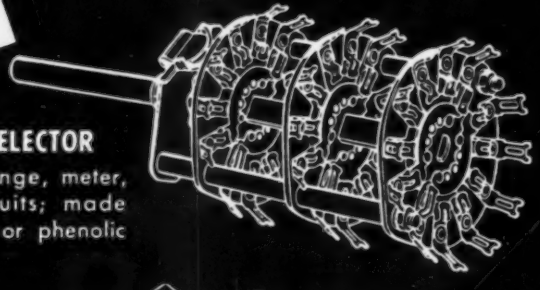

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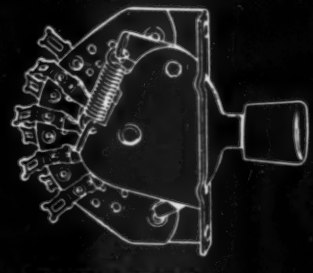

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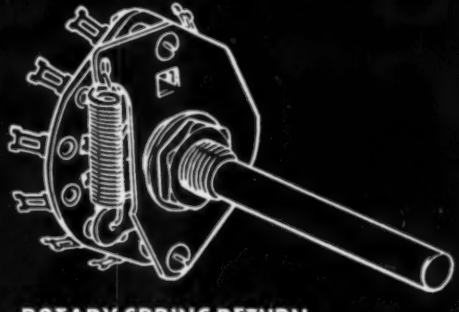

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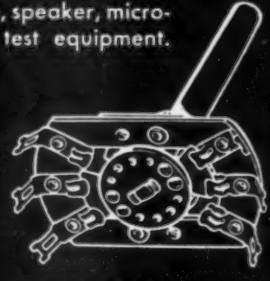

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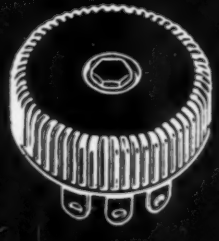

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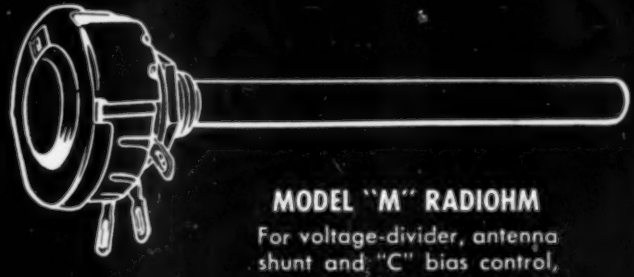

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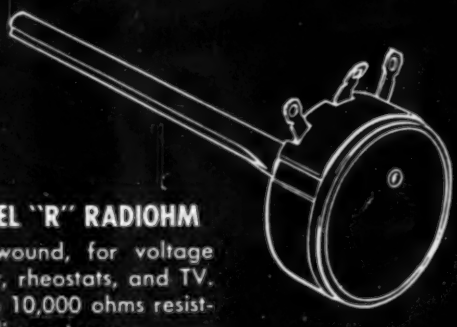

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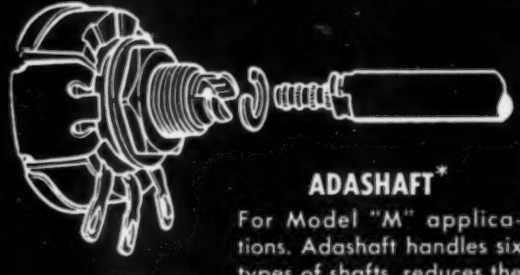

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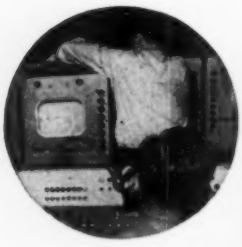

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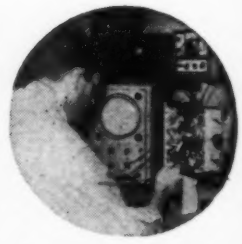

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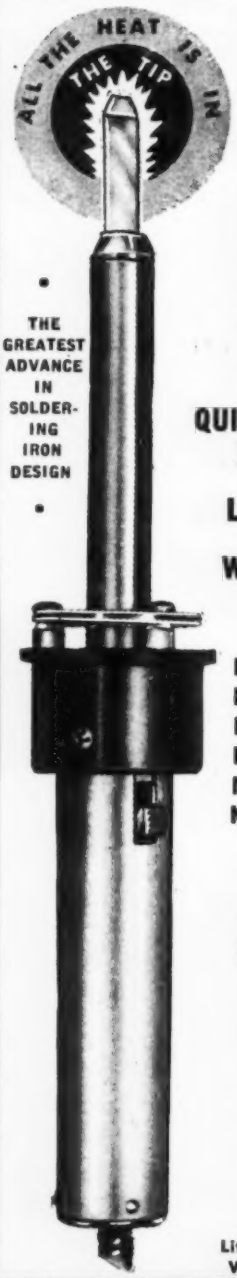

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Spot Radio News

★ ***Presenting latest information on the Radio Industry.***

By RADIO & TELEVISION NEWS' WASHINGTON EDITOR

TV. whose cyclonic role in sight and sound-casting has been critically screened by more experts, particularly of the Washington circle, than the records can ever disclose, entered the familiar allocations docket again some weeks ago, this time however facing what might be the most crucial trial of its unique career.

Although there was pre-trial evidence that the sessions would be intense, with industry sparking a few explosive items and the FCC just listening in, the scene was substantially reversed. From the opening hours, members of the Commission, especially Commissioners Robert F. Jones and Frieda B. Hennock, battered industry's witnesses with queries. Before the first recess was called, it became quite apparent that here was a session without parallel, a seething probe that would go on and on. Originally the full hearing was expected to last about six to ten weeks. After listening to the caustic and detailed examinations, there was grave doubt in everyone's mind that such a schedule could be kept, and that perhaps three to four months might sound more logical for a concluding date. When the general plan for the hearing was organized, color was given preference and in sequence followed time for consideration of ultra-high and very-high standards, nation-wide allocations, special types of telecasting such as Stratovision and polycasting, non-commercial educational use of TV, synchronized and offset carrier transmission, directional antennas and the extremely important item of freeze lifting. With the Commission indicating that there appeared to be weeks and weeks of work ahead on color alone, and that trips to other cities, including those on the Pacific Coast appeared necessary to judge adequately all the color systems that could be possibly used at present, the three-week period originally set aside for color began to fade with an additional three to four weeks looming for completion of the color debate.

As cited last month, *RCA* and *CBS*, who were the principals in the '46-'47 color saga, were again in the center of the ring, with at least two and perhaps three others vying for the limelight. These were *Color Television*, conducting tests with KPIX and KGO-TV in San Francisco, and Dr. Charles W. Geer, physics professor at the University of California and Dr. Leon Rubenstein, New York color and optical expert, whose definite appearance was not scheduled.

The static views of industry on color fired the direct-exam flame at the conclave. With Senator Ed Johnson and his committee stirring about for answers to the delay in color, the Bureau of Standards group selected by the Senator probing the problem, too, and other Congressional groups expressing acute interest in color, the Commission felt that it was really on the spot and they just had to find the answers, more answers that the legislators could and might find. Certainly, they opined, the industry's best talent in the witness box should be able to supply those replies. The Commission's strong impressions on color also stemmed from the comment of the FCC's own engineering department, particularly the words of acting chief engineer John A. Willoughby. A year ago, Willoughby disclosed, at a meeting of the South Carolina Broadcaster's Association, that color TV would be available in perhaps two years and that the region about 500 mc. would be used for such service as well as high-definition monochrome.

One word, compatibility, first uttered by JTAC chairman Don Fink, irked Commissioner Jones and the battle was on. It appeared as if the industry definition did not measure up to the FCC interpretation. A compatible system, according to industry, was one which would permit reception in black and white of all video programs telecast, on current-type receivers, whether the broadcasts be in color or in black and white. Supporting the stand of industry for compatibility, Raymond C. Cosgrove, RMA prexy, said that the trade was . . . "scared to death of converters and adapters" which would be required for a non-compatible setup. Madame Commissioner Hennock joined the compatible debate and asked why RMA had agreed to such a rigid definition of the word so early before viewing of all the systems scheduled for demonstration. Replying, the RMA spokesman said that their comment was directed to any system which might inconvenience the viewer and

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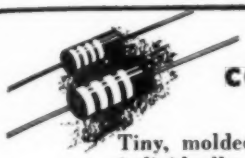

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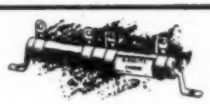

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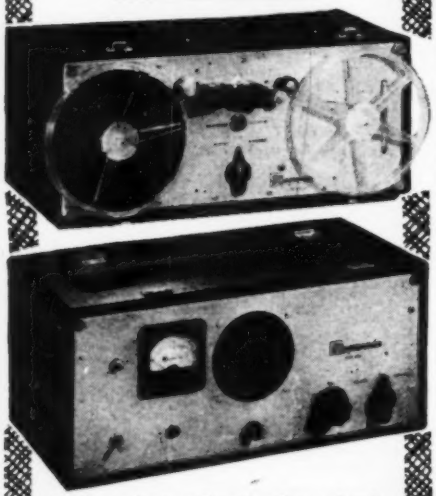

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perhaps introduce obsolescence through the need for involved converters.

Dr. Elmer W. Engstrom, director of research for *RCA*, was also a victim of the attractive Commissioner's blazing questions. After describing the *RCA* system, which was outlined in these columns last month, Engstrom was bluntly asked when he felt color would be ready. His reply was ". . . perhaps next spring." Madame Commissioner then said tartly: "It's always next spring or five years from now. We have been accused of suppressing color. Where are your cameras, transmitters and field equipment?" This tirade was followed by another blast which included the acid question: "Do you want color? . . . We are here to tell the public color is here, I figure. That's my job. Now, is it here?" Engstrom replied that he did not believe any manufacturer had color equipment available for commercial use and that the apparatus described during his testimony was of an experimental nature and could be produced on a quantity basis, but not too soon.

Explaining how existing black and white receivers could be converted to receive color through the *RCA* system, Engstrom said that either of three procedures could be adopted: (1) a separate converter unit containing the necessary electronic gear and picture tube viewing arrangement providing a 10-inch picture; (2) a projection unit which could be substituted for the picture tube in the monochrome receiver; and (3) a converter which would provide a second picture tube to the black and white receiver, providing a two-picture tube viewing combination.

IN A BLAST on the *RCA, CBS,* and *Color Television* systems, Thomas T. Goldsmith, Jr., director of research for *DuMont,* detailed just why the submitted systems were inadequate for commercial application today. Commenting on the Pacific Coast arrangement, Goldsmith said that this method, which according to the affidavit given to the FCC, uses a "single . . . image orthicon upon which . . . three separate primary color images are projected by . . . three separate lenses . . ." introduces degradation in picture quality. Misregistry occurs due to the optical system and more seriously due to the geometry of the scanned pattern, Goldsmith indicated, the latter being largely contingent upon the non-linearity of the horizontal scan. This misregistry problem seriously affects reception, and thus the system could not qualify as fully compatible with the present high-quality monochrome service, explained Goldsmith.

Describing difficulties which would appear in receivers designed for the *Color Television* system, Goldsmith said that the picture tube, which has a ". . . target area upon which three separate side-by-side image rasters are traced by the developed picture tube beam . . ." would show up all the registry problems inherent in the pickup tube device, with the addition of pincushion distortion of the scanned raster on a flat-face picture tube. It was pointed out that this distortion occurs both vertically and horizontally and introduces a further registry problem, since for good registry of the received image, the scanned areas must be geometrically identical.

In a criticism of the *CBS* system, the *DuMont* expert said that this method, which operates with a field repetition rate non-synchronous with the power line frequency, imposes special requirements of protection from power line frequencies at the studio and transmitter, and has necessitated operation from 144-cycle generators to avoid the disastrous effects of 60 and 120-cycle hum induced through power supplies, transformer fields, and filament wiring. These effects are also present at the viewing end, it was also learned, and while they can be minimized in specially designed color receivers, most present-day monochrome receivers contain enough 60 or 120-cycle components to produce poor interlace or line crawl and objectionable flicker due to the difference frequencies between these components and the color repetition rates. Goldsmith added that since this flicker can be as low as 12 cycles-per-second, it is observable at all usable picture brightnesses.

Commenting on the non-compatibility of the *Columbia* method, the *DuMont* spokesman said that that system requires an expensive converter to modify the scanning circuits of existing receivers from a line frequency of 15,750 to a line frequency of 29,160 per second and from a field frequency of 60 to a field frequency of 144 per second. In addition, the number of picture elements along each line presents a problem, the horizontal definition being 45% less than in standard receivers, according to Goldsmith, and the vertical definition 23% less than in standard TV models. He also pointed out that most commercial receivers would exhibit a lack of interlace and would flicker if adapted for the *CBS* transmission standards.

The *DuMont* brief also disclosed that the *CBS* electronic type receiver, which features projection with three lenses separated from each other with respect to the vertical scan (the *Color Television* system requires the three lenses separated from each other with respect to the horizontal scan), suffers from a change in color balance in the vertical plane. Thus, as the viewing position is moved above and below the center of the directional screen, a color change is noted.

Reviewing difficulties which might be encountered with the *RCA* dot-sequential method using line and picture-dot interlace, Goldsmith said that pictures might not be satisfactory because of dot-pattern problems. Explaining this condition, he said that the 3.8 mc. sine wave superimposed on the picture tube produces a dot pattern, and that if some part of the picture were all one color, such as red, any particular line in this area would be completely con-

(*Continued on page* 122)

YOU Need My PRACTICAL Training to Make Money in TELEVISION-RADIO and ELECTRONICS!

Learn at HOME IN YOUR SPARE TIME

I'll Send You 8 BIG KITS of Radio Parts and Equipment . . .

NOW IS THE TIME To Get Into This Fast Growing Industry—Prepare For A Fine Paying Job Or Your Own Business!

If you want to get into Radio-Television and Electronics . . . you owe it to yourself to get the facts about my training. I have trained hundreds of men to become outstanding service technicians—and I'm ready to do the same for you. Whether your goal is a fine paying job in one of Radio's many branches—or a successful Radio and Television business of your own—*you need the kind of training I offer!* My training is practical and down to earth. YOU NEED NO PREVIOUS EXPERIENCE. You'll be astonished at your rapid progress. I start you with basic fundamentals and give you plenty of practical shop-bench training with many kits of parts I send you. This is the training that sticks with you and makes money for you on the job!

Get Paid For Spare Time While Learning

Soon after you start training I send you my famous BUSINESS BUILDERS that show you how to make money in spare time doing interesting Radio jobs. Look at the useful and valuable equipment you get while training with me (illustrated at left)—I send you these 8 big kits of Radio parts and equipment and help you build step-by-step a powerful 6-tube superhet radio, a 16-range test meter, plus other mighty useful equipment for Radio and Television servicing. You will perform over 175 fascinating experiments while training. You will learn about Television—so that you will be qualified to step into this fast growing, profitable field. I also send you many valuable service manuals, diagrams and my book telling exactly how to set up your own Television and Radio shop. *I want you to learn all about my training*—and that is why I urge you to clip and mail the coupon below for my two big FREE Radio books. I employ no salesmen—and nobody will call on you. The important thing is to act now and get the facts.

HAVE A BUSINESS OF YOUR OWN

A profitable Radio and Television Service Shop may be started with little capital. I will show you how to get started and how to build your small business. At left is pictured one of my graduates, Mr. Merrit C. Sperry of Fairmont, Minnesota in his own shop. The way is also open for you to build a good SERVICE BUSINESS FOR YOURSELF.

ALL KITS ARE YOURS TO KEEP

Each of the hundreds of Radio parts and other items I send my students is theirs "for keeps." You may use this equipment in your Radio and Television service work and save many dollars by not having to buy expensive "ready-made" test equipment. Each of my 8 kits will help you advance and learn important steps in Radio and Television servicing.

CALVIN SKINNER of New Orleans, La. tells us he makes $5 to $10 in spare time repairing radios. He is now also working with his own Television set.

LOREN D. SAUCIER of Cotoma, Mich. reports that my training has made it possible for him to repair large numbers of Radio and Television receivers.

RADIO AND TELEVISION INDUSTRY BOOMING

You couldn't pick a better time to get into Radio-Television and Electronics. New Television stations are going on the air to serve every major city—hundreds of new AM and FM Radio broadcasting stations are also on the air to serve practically every community in America. All this creates new and bigger opportunities for the trained man who knows Radio-Television and Electronics. Good Radio and Television service men are needed NOW!

VETERANS

THIS TRAINING AVAILABLE TO YOU UNDER THE G.I. BILL

My Training Includes:

Radio Servicing
Television
FM Frequency Modulation
Public Address and High Frequency Applications

These Two Big Radio Books FREE!

Just mail coupon for a FREE sample Sprayberry Lesson and my big FREE book, "How To Make Money In Radio-Television and Electronics." Learn why my really *practical* training is best of all for you. Discover what's ahead for you in the fast moving Radio-Television and Electronics industry. No obligation. Don't delay—the future is too important to you. Mail the coupon now—and count on me for fast action.

RUSH COUPON Today!

SPRAYBERRY ACADEMY of RADIO, Dept. 25-D
111 North Canal St., Chicago 6, Ill.

Please rush my FREE copies of "How To Make Money In Radio-Television and Electronics" and "How To Read Radio Diagrams and Symbols."

Name.....Age.....

Address.....

City.....State.....

( ) Check here if you are a Veteran.

SPRAYBERRY ACADEMY OF RADIO
111 N. CANAL, DEPT. 25-D, CHICAGO 6, ILL.

RADIO TALL TALES CONTEST

How good are you at telling tall stories? Put your imagination to work and win $$$. Each month, Niagara Radio will publish the best "Tall Tale" submitted during the previous month. Authors of published "Tall Tales" will receive **$5.00 in cash.** No obligation, no box tops, anyone can compete. Send your radio "Tall Tales," in 50 words or less, to "Tall Tales" c/o Niagara (address below). All "Tall Tales" submitted become the property of Niagara Radio Supply Corp.

Niagara Presents

GIFT ITEMS at GIVE-AWAY PRICES!

"ONCE-IN-A-LIFETIME" VALUES

Such as THESE!

Check Every One!

LM. FREQ. METER, xtal, book, mod. V.G. **$90.00**
TBY NAVY 6 & 10 mtr. transceiver complete 44.95
HANDY 10 meter converter, new 24.95
BEACH Model 1700 80 meter VFO, new 19.95
GON-SET 50-54 Mcs. converter, like new 27.50
RME-69 With spkr. excel. 79.95
HUDSON MARINE 6 chan. 70w xmtr-rcvr, NEW **$50.00**
BC-375 TUNING UNITS V.G. 3.95
GE MOBILE XMTR. Model GF4A 25w. L.N. 34.95
McMURDO SILVER 801 6-80 mtr. rcvr. COMPLETE 34.95
GIBSON GIRL emerg. xmtr, NEW 2.89
ATD NAVY 50 Watt xmtr. 40-80 mtrs., NEW 49.95
JQ NAVY 6v. portable audio amplif., VY GD. 9.95
BC 221 freq. mtr. w/xtal & calib. book, EXC. 75.00
BC 342 NAVY communications rcvr. 110 v.ac. 75.00
NAT'L I-10A RCVR w/coils, less pwr. sup., L.N. 42.00
CRV NAVY Rcvr. 100-1500 kc. w/tubes, Very Good 14.95
T2-27/TSM resistance bridge (w/galvanomtr.) 75.00
BC-614-D speech amplifier for BC-610, NEW 45.00
W1252 electronic wavemeter, 22-30 Mcs., Exc. 49.95

T-17 MIKE

Lowest Price Ever! Slightly used, guaranteed perfect and clean. Single button carbon handmike. Light, efficient. 200 ohms. Press-to-talk switch, 5-ft. rubber cord with PL-68 plug attached.

Cat. No. N-249
SPECIAL **69c**

$1,000,000 STOCK BRAND NEW TUBES

Famous Brands . . . All Branded and Boxed

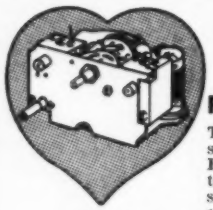
REDUCED MORE THAN 50%

TRANSMITTING		RECEIVING	
E1148	$0.34	1H5GT	$0.55
2C26	.28	3A4	.27
5BP1	1.70	3B7	.29
10Y	.28	3D6	.29
211	.28	6C4	.28
803	3.63	6AR5	.54
805	3.63	6D6	.55
813	6.90	6K7GT	.54
815	1.37	6SH7	.27
843	.38	6SS7	.53
954	.18	7C4	.28
955	.18	12A6	.28
957	.18	12H6	.29
958A	.18	12K7GT	.53
1619	.18	12SH7	.29
1625	.18	12SR7	.29
1626	.18	28D7	.29
7193	.47	35L6GT	.53
9004	.18	50B5	.55
9006	.18	50L6GT	.54

ALL QUANTITIES LIMITED

Compare these prices with our full-page listing elsewhere in this publication.

SUPER SURPLUS SPECIALS



HEART OF THE BC-221 FREQ. METER

This VFO Sub-Assembly, used in BC-221 Freq. Meter, is ideally suited for home construction of:

1—Amateur V.F.O.
2—Freq. Mtr. Foundation
3—Portable Transmitter
4—Replacement for BC-221

Unit contains two temperature & moisture compensating coils, wafer switch, 3 variable condensers, carbon resistors, & silver mica condensers. FULLY WIRED & mounted on sturdy aluminum sub-chassis, ready for installation. Brand new—in original packing.

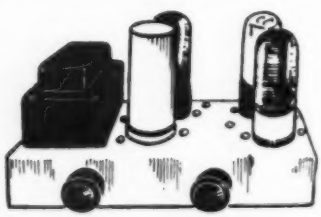
N-276. Very special..... **$6.95**

BT CUT 1000 KC XTAL

When used in above assembly, will make a fully self-contained harmonic generator from 125 KC to 20,000 KC.

N-189. Special **$4.95**

5-WATT AUDIO AMPLIFIER



Audio amplifier (NOT A KIT) delivering full 5 watts, fine tone and frequency response. Complete with tubes, output transformer, volume and tone controls. Real quality equipment—not to be confused with AC-DC amplifiers of nondescript value. 115 V. 60 Cy. Input.

Cat. No. N-185. Your Cost..... $12.50

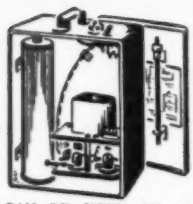
CROWN ANTENNA ROTATOR

With BUILT IN Direction Indicator

A brand new innovation in ham or TV beam rotators, the XB rotator, complete with control box, direction indicator, built-in thrust bearing (175 lb. thrust), fully water proofed, sealed-in-oil gear train and direction transmitter built into motor housing. Motor is sturdy enough to be mounted at BOTTOM of mast. Will take either stacked TV or ham antennas. Full 360 degree rotation in about 40 seconds. Automatic stop at end of each revolution. Indicator lights only when switch is pressed, thereby avoiding glare and affording economical operation.

Cat. No. N-194. Your Cost..... $39.66

NIAGARA'S GOLD-PLATED SPECIAL!



An ultra-high freq. Gold Plated Cavity Resonator with a range of 234-258 Mcs! Fully wired, including two 955 acorn tubes. Designed by the navy for use as a portable modulated test oscillator. CAN BE USED AS A MODULATED SIGNAL GENERATOR. Battery compartment is large enough to house speech equipment and power supply, making it a desirable portable UHF Transmitter for Ham use. Complete with tuning wrench, tubes, whip antenna, and circuit diagram on inside cover. Black wrinkle finished cabinet measures 9½"x 6½"x6¾".

The Buy of a Lifetime!
Cat. No. N-257. SPECIAL..... $3.95

WAVE TRAPS

Traps consist of two slug-tuned silver-ized coils and two ceramic condensers. All mounted on a cadmium plated bracket conveniently drilled and ready for mounting. May be used to eliminate FM sound bars in TV sets, eliminate amateur interference (shock excitation) in TV Rcvrs. Match Hi-Lo TV antennas, and dozens of other uses too numerous to mention. They're going fast, so order yours today.

Cat. No. N-128. SPECIAL..... 39c Each; 3 for $1.00

TINIEST V.O.M. IN THE WORLD

NIAGARA exclusively presents the "Universal Baby Tester" measuring 3⅜" x 2⅛" x 1⅝"!!! Contains a sensitive 0-240 microammeter with the following ranges.

- 0-15 V AC or DC
- 0-150V AC or DC
- 0-750V AC or DC
- 0-150 DC MA.
- 0-100,000 ohms

Ohms adjust and DC-AC-OHMS switch. Includes 1 pair test leads. Will fit into your watch pocket. **Fully guaranteed. Cat. No. N-258.** Special **$8.95**

IMPORTANT NOTICE: Please include 20% deposit with C.O.D. orders, unless rated. Orders received without postage will be shipped railway express collect. Send us your inquiries today. We correspond in English, Spanish, French, Italian, Polish, Rumanian, Hebrew, German, Portuguese, etc. Prices subject to change without notice. All stock subject to prior sale.

Niagara Radio Supply Corp.

DEPT. N 129 — 160 Greenwich Street, New York 6, N. Y.

Phone Digby 9-1132-3-4

NIAGARA RADIO SUPPLY CORP.
Dept. N-129
160 Greenwich St., New York 6, N. Y.

☐ Rush items on attached list.

☐ Place my name on mailing list to receive special bulletins of limited-quantity bargains.

Name.....

Address.....

City..... State.....

5000 SERVICEMEN HAVE PROFITED FROM SYLVANIA'S DEALER ADVERTISING CAMPAIGNS

. . . and YOU can do the same by ACTING NOW!

Another of Sylvania's famous profit-building campaigns is getting under way! The campaign runs through the months of January, February, March and April—with half-page ads like this in LIFE, THE SATURDAY EVENING POST, LOOK, COLLIER'S, and RADIO AND TELEVISION BEST. The ads tell *your* customers and prospects to come to you for radio and television service.

But that's just the start! THEN . . . *you* tie in with this national advertising by using Sylvania's complete kit of display and direct mail material—all built *around* the ads—designed for *you*—and ready for you *now!*

Sylvania's previous campaigns paid off in a big way for thousands of dealers and servicemen. Be ready to cash in on this latest big push!

RADIO TELEVISION SERVICE
SYLVANIA RADIO TUBES
Authorized Dealer

LOOK FOR THIS SIGN OF DEPENDABLE RADIO SERVICE

Does your radio give out with squeals and grunts? Then call the serviceman who displays the Sylvania sign. Because your radio needs expert care, the kind this fellow is trained to give. He has Sylvania test equipment to root out trouble spots . . . high-quality Sylvania radio tubes to bring you the crystal-clear reception you want. Hear your old set perform as it did the day you bought it. Get it fixed at the Sylvania sign of dependable service.

SYLVANIA RADIO TUBES
PRODUCT OF SYLVANIA ELECTRIC PRODUCTS INC.

HERE'S WHAT YOU GET IN THE SYLVANIA KIT:

1 POST CARDS. You get 4 sets of Postal Card Mailings—one for each month in the campaign. They're in 3 colors—imprinted with your name and address! You pay *only* the government postage on each card—that's *all* you pay for the entire kit! EVERYTHING ELSE IS FREE.

2 WINDOW DISPLAYS. You get 2 Window Displays—featuring the same illustrations as the Sylvania national ads. 3-dimensional—4 colors—2 by 3 feet. 2 COUNTER CARDS, too, 12 by 18 inches.

3 AD MATS. You get 4 Newspaper Ad Mats—two sizes for each 2-month period. Sizes are one and two columns wide, 7 inches deep. Easy way to tie your local newspaper advertising in with Sylvania's national ads!

4 STREAMERS. You get 2 Window Streamers—in 2 colors—11 by 26 inches. Like the other items in the campaign, Streamers feature *both* radio *and* television service.

5 RADIO SPOT ANNOUNCEMENTS. You get 4 booklets of Radio Spot Announcements—one for each of the 4 months in the campaign. When you've planned your schedule, just hand the spots to your local radio station—they're all ready to use!

Mail coupon today for full details on the complete campaign!

RADIO TELEVISION SERVICE
SYLVANIA RADIO TUBES
Authorized Dealer

DECALS. You get as many Decals as you need—in 8 or 12 inch diameter. Your choice of wording—RADIO SERVICE or RADIO TELEVISION SERVICE. Sylvania's ads make these Decals nationally known—cash in on their familiarity!

Sylvania Electric Products Inc.
Advertising Dept. R-1012, Emporium, Pa.

Please send full details of your new 1950 January, February, March and April Service Dealer Campaigns.

NAME.....

COMPANY.....

ADDRESS.....

CITY..... ZONE.... STATE.....

SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, SIGN TUBING; LIGHT BULBS; PHOTOLAMPS

ORDER from ARROW!

Most Complete Stock in the Country!

AN/APN-4

Indicator: Uses 5 CP1, Loran, convert to test scope, panadapter, etc. Contains extremely accurate 100 kc xtal to time sweeps and marker pips at 2, 20 and 100 kc. Two parallel horizontal sweeps, obtain time differences between signals, between half power points on passband curves, and numerous other scope uses. Experimenters' delight! Use the counter circuits to try the new system of FM demodulation (July Proc. IRE) or to time camera shutters, 25 tubes. Condition: used, excellent. With schematic **$29.50**

RECEIVER

Easily Converted for Use in Citizens Band

Crystal Controlled Local Oscillator. Broad Band Pass—20.7 MC I.F.'s. Complete with 7-6AJ5, 1—12SR7, 2—12SN7, 1—28D7, relays, crystals. Schematic furnished.....Used **$7.95**

SURPRISE PACKAGE 20 lbs. Ass't radio parts. A $25.00 value for only..... **$1.95**

RESISTOR KIT—(Long leads New) 100 Ass'td..... **98c**

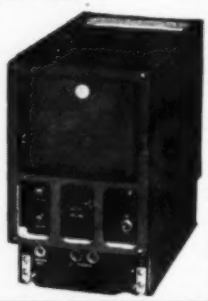
BC-620 F.M.—Receiver, Transmitter—2 channel crystal—Freq. 20-27.8 MC, 13 tubes—metered plate and fil.....New **$14.95**
Used **$9.95**

FT-250 Mount for PE-97 and BC-620..... **$1.50**

OUTPUT TRANSFORMER

Hi-Fil used in Scott Manufactured Navy receiver. Fully potted. Pri. 5000 ohms; output secondary 600 ohms C.T.—Inverse feedback secondary CT-60 ohms. New..... **$1.45**

BC-605 INTERPHONE AMPLIFIER



Easily converted to an ideal inter communications set for office — home — or factory.

Original New..... **$4.95**

Like new..... **3.95**

(With schematic)

CONVERSION DIAGRAM AND INSTRUCTIONS

complete with necessary parts.

This kit consists of 3 tubes—2 speakers—1 speaker baffle (for remote speaker)—100 ft. 2-cord cable—1 switch—1 line cord—2 etched plates—miscellaneous resistors—condensers—hardware—and all that is necessary to convert. New **$8.25**

BC-604 TRANSMITTER FM 20-28 MC

11 and 15 meters. Can be operated on 10 meters—10 channel push button crystal. With all tubes and meter but less dynamotor. Excellent Condition..... **$12.95**

Crystals—Set of 80..... **14.95**

FLAP PITCH MOTOR

24V DC will operate on AC—11,000 RPM. Complete with gear box and limit switches.....ea. **$2.95**

DYNAMOTORS

DM-28—For BC-348 with Mount and Filter	New	$6.95
	Used	3.95
DY-12—For ART-13 less filter and base	New	9.95
DM-38	Used	.95
	New	1.95
BD-77	New	5.95
PE-206	New	6.95
	Used	2.75
PE-101	New	2.75
DM-53	New	3.95
(3 for $2.00)	Used	.95
DM-32	New	1.95
(3 for $2.00)	Used	.95

COMMAND (SCR 274 N) EQUIPMENT

	Used	New
BC-453	$12.95	
BC-454	4.95	$6.95
BC-455	7.95	
BC-456	1.95	2.95
BC-457	5.95	
BC-458	5.95	7.95
BC-459 (or T22)	9.95	
BC-696 (or T19)	14.95	24.95
ARC5 Transm. 2.1-3MC	9.95	
BC-450—3 Receiver Remote Control	.89	1.95
BC-442		2.95
3 Receiver Rack	1.95	
2 Transmitter Rack	1.50	

Complete Command set as removed from aircraft—3 receivers—2 transmitters—Relay unit—control boxes—mounting racks—plugs—modulator and dynamotors—crated. Set **$34.50**

PE-97 6-12 Volt Vibrator Power Supply for BC 620.
Excellent—used—complete..... **$6.95**
Less Vibrator—tubes—condenser..... **2.95**

HERMETICALLY SEALED CHOKES

10 H.	100 M.A.	59c
59 H.	100 M.A.	95c
3.7 H.	145 M.A.	59c
10 H.	20 M.A.	39c

BC-223

Ideal Marine or Ham Transmitter 2000 to 5250 KC

New with all tuning units and T. U. cases	$29.50
Tuning Units—For BC-223	2.50
Cases—for Tuning Units—for BC-223	.95

PP 12A/APS-3 RECTIFIER POWER SUPPLY

110 VAC—800 to 2400 CPS input. Used to supply many voltages for APS 3 equipment. Contains four VR105; Three 5U4G; 2x2; 6AC7; 6Y6-G; VR 150; 6X5GT-G, condensers, chokes, etc. Parts alone worth more than..... **$6.95**

CONDENSERS

	Each
2 mfd. 4000 VDC G.E.	$2.95
	4 for 10.00
2 mfd. 5000 VDC. G.E.	3.95
	3 for 10.00
1 mfd. 6000 VDC	2.75
	2 for 5.00
.25 mfd. 15000 VDC	4.95
.00025 mfd. 25000 VDC	2.95

TUBES

304 TL	90c each....4 for	$3.00
5BP1		1.95
5BP4		2.95
4AP10		.95
211		.49
1625		.29
872A-GE		2.95
872A		1.29

Tube Shield for 3 BP1—Heavy Metal grommeted. New..... $1.50
Socket for 3BP1.....New .95
Socket for 5CP1.....New .95

BEAM INDICATORS

I 82—5".....New		$4.95
Transmitter selsyn for above		2.45
	both for	7.00
I 81—3".....New		3.45
Transmitter Selsyn for above		2.45
	both for	5.25
I 81	Used	2.45

NEW CATALOG

listing many surplus values, write for your **FREE** copy TODAY.

MIKES—HEADSETS

HS-23 Hi Imp.	New	$2.95
HS-33 Lo Imp.	New	2.95
HS-30 Hi Imp.	New	1.50
	Used	.79
T-17D Carbon Mike	New	2.75
T-24 Hi Imp. Carbon Mike	New	1.19
T-30 Throat Mike	New	.98
T-45 (or Navy) Lip Mike	New	.98
CD-307 Extension Cord for Headsets	New	.59
RS-38—Navy hand Mike Carbon		2.75

All shipments FOB Chicago. 20% Deposit required on all orders. Minimum order accepted—$5.00. Illinois residents, please add regular sales tax to your remittance.

ARROW SALES, Inc.
Dept. N
1712-14 S. Michigan Ave., Chicago 16, Ill.
PHONE: HArrison 7-9374

MISCELLANEOUS SPECIALS

ARB Receiver 200 to 9000 Kc.	Exc., Used	$19.95
AVT 120 Receiver 2300 to 6500 Kc.	Used	4.95
SCR 522 Transceiver 100 to 156 MC.	Used	34.95
BC 1206 Receiver 200 to 400 KC	New	5.95
	Used	3.95
MN 26 C or Y Receiver	New	24.95
	Used	17.50
RA 10 DA Receiver	New	24.95
	Used	17.50
RT 7—APN-1 Transceiver	New	9.95
APN-1 complete	New	34.50
R-78—APS 15—Complete with Tubes	Excellent	34.50
AM 61 Indicator Amplifier	New	9.50
BC 929 Scope	New	17.95
	Used	12.95
SCR 625 Mine Detector	New	39.50
C 1 Autopilot with Tubes, Etc.	Used	2.95
ASB-7 Scope	Used	12.95
BC 461 Veeder Root Meter	New	.59
BC 442 Less Condenser	Used	1.49
BC 342-J—BC-312-J—Manual		1.00
SCR 269 G Manual		2.50
BC 306 Antenna T.U. for BC 375		1.50
A-27 Phantom Antenna—2000 to 4500 KC	New	.95

APS-13 UHF Antenna—Suitable for 400 MC citizen band, ideal for UHF experimenters. With director and reflector elements....Brand New, 2 for 98c

NATIONAL TELEVISION

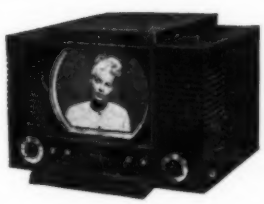
Presents 2 ALL-NEW 1950 MODELS

YOU'LL BE SOLD ON *Sight*

Place these two new 1950 National Television receivers side by side with any other television receiver. Compare the large (12½") screen — compare the chassis — compare the picture quality — compare the cabinet styling. Because National Television is custom assembled — not mass-produced — there just *is* no comparison! Yet it costs no more.

Model TV-12W
Striking modern mahogany table model with 12½" tube and 2 six-inch oval speakers.
$269.95

Model TV-1225
A 12½" picture tube and a 10" speaker in a handsome mahogany console.
$299.95



● **Model TV-10W**
Genuine mahogany table model with 10" screen and 2 six-inch oval speakers.
$229.95

● **Model TV-7W**
Unbeatable TV dollar value. 7" screen with twin speakers. NC enlarging lens available, $16.95.
$129.95

● **Model TV-7M**
Metal cabinet version of TV-7W. Ideal as "second set" for playroom, den or bedroom.
$119.95

(1) Latest flyback high voltage supply gives clear, bright pictures even in fringe areas. (2) Automatic frequency control locks picture in place. (3) Exceptionally wide video band-width for beautiful clarity of detail. (4) Front-of-panel focus control. (5) Coil switching assures equivalent of separate, high-Q tuned circuits for each channel. (6) Automatic gain control. (7) 3-stage 37 mc IF minimizes picture interference caused by other radio services. (8) Double-tuned RF bandpass circuits improve selectivity and image ratio. (9) Automatic Station Selector and fine tuning control.

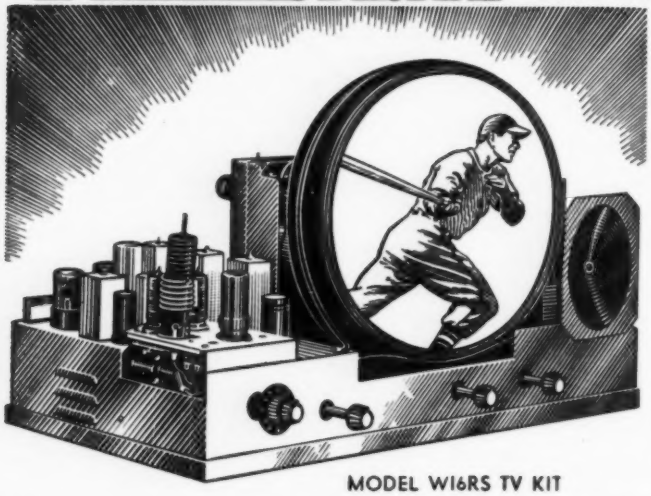
Prices slightly higher west of the Rockies

National

EST. 1914

NATIONAL COMPANY, Inc.
MALDEN, MASSACHUSETTS

TRANSVISION TELEVISION KITS AND INSTRUMENTS



MODEL W16RS TV KIT

16" Build it in 1 Day!

GIANT 160 Sq. In. PICTURE; Has 16" PICTURE TUBE

(All-Glass Picture Tube, giving bright, clear, steady picture.)

- **KIT COMES SEMI-WIRED and ALIGNED Can be completed in one day!**
- **SAVE by installing the set yourself.**

• WAY UNDER $200!

SAVE UP TO ½ **on the cost of equivalent picture-size sets. For *NEW LOW PRICES*, see your Transvision Outlet listed below.**

Eliminate the Variables in Television Installation with the Transvision FIELD STRENGTH METER

Improves Installations! ! Saves ½ the work! !

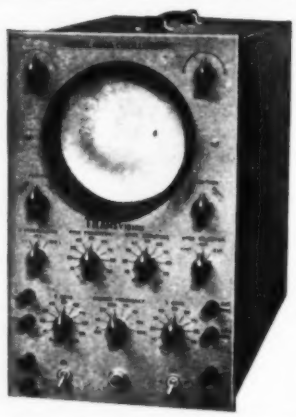
Has numerous features and advantages, including—(1) Measures actual picture signal strength . . . (2) Permits actual picture signal measurements without the use of a complete television set.

(3) Antenna orientation can be done exactly . . . (4) Measures losses or gain of various antenna and lead-in combinations . . . (5) Useful for checking receiver re-radiation (local oscillator) . . . (6) 12 CHANNEL SELECTOR . . . (7) Amplitudes of interfering signals can be checked . . . (8) Weighs only 5 lbs. . . . (9) Individually calibrated. . . . (10) Housed in attractive metal carrying case . . . (11) Initial cost of this unit is covered after only 3 or 4 installations . (12) Operates on 110V, 60 Cycles, AC.

NEW LOW PRICE

Model FSM-1, complete with tubes Net $79.50

New! Transvision 5" OSCILLOSCOPE



Ideal for Television Servicing . . . Costs only $99, yet is equal to instruments selling for almost twice as much.

Vertical Amplifier Response to 1 MC—Sensitivity: .15 RMS Volts/inch

SPECIFICATIONS: Hor. Amp. 2 cycles to 500 kc . . . Decade Attenuators (Frequency Compensated) . . . Direct connection to deflection plates . . . Z Axis Input . . . Calibration Test Signal . . . Pushpull amplifiers on horizontal and vertical . . . Three stage amplification on both . . . Sweep Frequency to 50 kc.

Vert. Amp. 2-6SN7; Hor. Amp. 2-6SN7, 5BPI, 5Y3, and 2x2; 884 Sweep Generator. Cased in hammertone grey cabinet, complete with booklet on "How to Use an Oscilloscope." GUARANTEED.

Transvision Model 450A. . . . . Net $99.00

TRANSVISION, INC., Dept. RN, New Rochelle, N. Y.

All Transvision Prices are fair traded; subject to change without notice. Prices 5% higher west of the Mississippi

For FREE 20-page TV BOOKLET and CATALOG SHEETS, SEE YOUR TRANSVISION OUTLET!

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	3471 California St., San Francisco		75 Church St., New York City
DEL:	4 East 15th St., Wilmington		606 Central Park Ave., Yonkers
FLA:	42 Southeast Eighth St., Miami		622 No. Salina St., Syracuse
ILL:	1002 So. Michigan Ave., Chicago	OHIO:	901 Race St., Cincinnati
MD:	1912 No. Charles St., Baltimore		2001 Euclid Ave., Cleveland
MASS:	1306 Boylston St., Boston		53 W. Norwich Ave., Columbus
MICH:	23216 Wilson Ave., Dearborn	PENNA:	235 N. Broad St., Philadelphia
N. J.:	601 Broad St., Newark		620 Grant St., Pittsburgh
N. Y.:	1425 Boscobel Ave., The Bronx	TEXAS:	700 Commerce St., Dallas
	485 Coney Island Ave., Brooklyn	CANADA:	Hamilton, Ont.

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Become the TV SALES and SERVICE CENTER IN YOUR COMMUNITY

- **Beat competition at a profit.**
- **Stop being undersold — by *anybody!***

Here's a real opportunity to MAKE MONEY in Television. If you can qualify, you can become the Transvision Television Center in your community—and BUY TV and RADIO PARTS AT JOBBER PRICES. Practically no investment required. This offer is open only to service-dealers in territories where we do not have an authorized distributor.

Contact Transvision Outlets listed, or write to New Rochelle, for details on Transvision's "TV Center Plan." DO IT TODAY!

- **NO FORCED PURCHASES**
- **NO "TIE-IN" DEALS**
- **NO CAPITAL PROBLEM**
- **NO INVENTORY PROBLEM**

Get the FACTS about the amazing Transvision Dealer Plan. It will give you a big stake and big future in television.

FILL OUT AND MAIL THIS COUPON NOW!

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NEW ROCHELLE, N. Y.

Please ship THROUGH YOUR NEAREST LOCAL OUTLET: RN-12

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I am enclosing 10% DEPOSIT in the amount of $ . . . . . , balance C.O.D.

( ) Send details of TV CENTER PLAN.

Name . . . . . .
(please print)

Address . . . . . .

City & State . . . . . .

Guaranteed Accuracy

High Voltage Rating

Excellent Frequency Characteristics

High Stability

Moderate Cost

NOW...

PRECISTORS!

Here, at last, is a *deposited carbon* resistor ideally suited to the needs of electronic engineers, experimenters, hams and radio technicians. PRECISTORS combine more desirable characteristics than any other type of resistor—and save you money too.

Made of pure crystalline carbon bonded to selected ceramic cores, PRECISTORS are particularly recommended for circuits where carbon compositions are unsuitable and wire-wound precisions too expensive. For close tolerance, high stability *and* economy, use PRECISTORS . . . in such applications as:—

VOLTMETER MULTIPLIERS

PRECISTORS are outstanding replacements in all kinds of test equipment. They are thoroughly reliable, yet inexpensive for amateurs and experimenters who construct their own special testing devices.

HIGH VOLTAGE BLEEDER APPLICATIONS

Rated at 6000 volts peak, one or two **PRECISTORS** will replace entire strings of insulated resistors in television high voltage or similar bleeder circuits. They are especially well suited as bleeder resistors in voltage doubling and tripling circuits.

HIGH FREQUENCY REQUIREMENTS

Having considerably better frequency characteristics than insulated resistors, **PRECISTORS** may be used to definite advantage in high frequency circuits where resistance value is critical.

ELECTRONIC EQUIPMENT

PRECISTORS are well suited to electronic equipment subject to widely varying temperatures. Uniform temperature characteristics assure reliable prediction of resistance under such conditions.

AUDIO AMPLIFIERS

PRECISTORS are especially important in high-gain and high-quality audio amplifiers. Their inherently low noise level and excellent stability make these pure carbon resistors ideal for low level input systems and for balanced push-pull circuits.

VOLTAGE DIVIDERS

PRECISTORS afford opportunity for an endless variety of low-powered, precision voltage dividers in innumerable applications.

SUBSTITUTES FOR WIRE-WOUND PRECISIONS

High range **PRECISTORS** cost but a fraction of the price of high range wire-wound precisions, and are available in values which are not practicable for wire-wound types. Distributor stocks afford a wide selection of values which may be connected in series or parallel to accommodate an exceptionally wide number of special values, quickly and at relatively low cost.

PRECISION PACKAGING SAFEGUARDS PRECISTORS

IRC PRECISTORS are factory packed in capped plastic tubes for complete protection against scratches, jars and surface injury. This special precision packaging also safeguards **PRECISTORS** against excessive handling. Characteristics are printed on the case, and range, type and tolerance are clearly designated on each resistor.

SEND FOR FREE DATA BULLETIN

Full information on **IRC PRECISTORS** is yours for the asking—characteristics, ratings, applications. Send for your free copy of catalog DC-3 today. International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa. *In Canada:* International Resistance Co., Ltd., Toronto, Licensee.

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Within the INDUSTRY

PERCY L. SPENCER, veteran tube man and manager of the *Raytheon* Power Tube Division, was awarded the Navy's Distinguished Public Service Award, the highest honor the Navy can bestow on a civilian, at ceremonies held recently in the company's Waltham, Massachusetts power tube headquarters.

In making the presentation, Rear Admiral Hewett Thebaud cited Mr. Spencer for his work in microwave magnetron development with special reference to the improved methods for volume magnetron production.

Mr. Spencer is now actively engaged in the engineering and production of the company's line of cathode-ray tubes.

* * *

BRONISLAW ZAPOLSKI, nationally famous product designer, has completed styling of the new 1950 radio line being offered by *Jewel Radio Corporation* of Long Island City, N. Y.

Mr. Zapolski, for four years with *Raymond Loewy Associates,* is a specialist in radio and television design. He has, however, styled store interiors and exteriors, as well as a variety of products ranging from photographic equipment to brushes. He recently completed a four-month tour of the British Isles and France where he observed product style trends.

* * *

DR. E. F. W. ALEXANDERSON, radio and television pioneer whose high-frequency alternator gave America its start in the field of radio communication, was recently honored at an anniversary observance of the first practical use of this invention, the sending of President Woodrow Wilson's peace terms to Germany at the close of the first World War. A bronze plaque commemorating the event was unveiled on the walls of station WGY in Schenectady.

Dr. Alexanderson, now retired but still serving as a consultant, holds a record of being *General Electric Company's* most prolific living inventor with a total of 315 patents, or an average of one every seven weeks during his 46 years of active service with the company. He retired from *General Electric* in January, 1948.

* * *

NATIONAL TELEVISION DEALERS ASSN., Inc. has just been incorporated under the laws of Maryland as an organization "dedicated to promoting the best interests of retail television dealers, uniting members of the television retailing industry in all lawful measures for its common good, and engaging in any or all proper trade association activities."

Membership in the new organization is open to individuals, partnerships, or corporations engaged in the retailing of television equipment at a regularly established place or places of business.

The association maintains offices at 402-3 Washington Building, Washington 5, D. C. Edwin A. Dempsey is serving as executive director of the new group.

* * *

WESTERN ELECTRIC COMPANY has announced its withdrawal from commercial activities in microphones, loudspeakers, and disc reproducing equipment.

Uninterrupted service and availability of maintenance parts have been assured to protect users by an agreement between *Western Electric* and the *Altec Lansing Corporation.*

The continuing specialized needs of the *Bell Telephone System,* combined with the growing requirements of the armed forces for the development of complex electronic equipment were cited as among the factors causing the company's decision to withdraw from the field.

* * *

MILTON LANDAU has been appointed to the post of director of purchasing by the *Tele King Corp.* of New York City, makers of the *Tele King* line of television receivers.

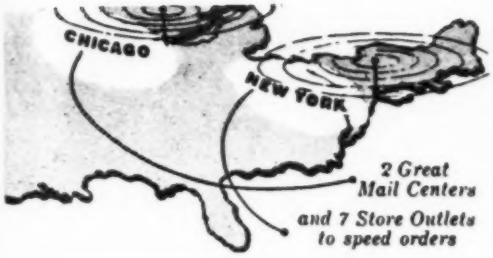
Mr. Landau, a veteran in radio and television fields, has been associated with the industry for the past twenty-seven years. He formerly was connected with such companies as *Hamilton Radio, Charles Freshman Co.* and a number of other organizations.

He will maintain headquarters at the company's New York City offices, located at 601 West 26th Street.

* * *

NATIONAL ELECTRONIC DISTRIBUTORS ASSN. recently held its annual meeting of the board of directors in Cleveland, Ohio.

The present slate of officers including Louis W. Hatry, president; Arthur C. Stallman, first vice-president; Aaron Lippman, treasurer; and Lealis L. Hale, secretary was re-elected. A. W. Greeson, Jr. was named second vice-president to fill the vacancy caused by the withdrawal from active participation in association affairs by



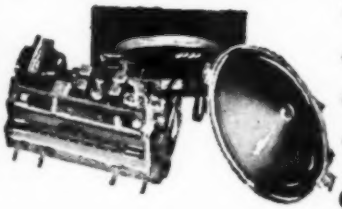
Lafayette RADIO ELECTRONEWS

★★★★ 29 YEARS SERVING & SAVING MONEY AND TIME FOR 500,000 HAPPY CUSTOMERS ★★★★

FREE! GET YOURS QUICK!

(IF YOU DELAY THERE MAY BE NONE LEFT—SO MAIL COUPON NOW!)

SUPERB CHASSIS BRINGS WIDE ACCLAIM



COMPLETE AM-FM RADIO

- **Static-Free FM**
- **8 Tube Superhet**
- **10 Inch Speaker**

ONLY $47.50 with Tubes

Here's a powerful, deluxe FM-AM chassis that brings in regular broadcast programs plus brilliant, staticless FM — a two-band receiver for the price of one! This complete unit includes a built-in power supply, 10" speaker and loop antenna for AM reception...ready for installation in a suitable cabinet. Highly selective and sensitive circuit covers 550-1600 KC and 88-108 MC bands. Connection is provided for an external FM antenna, and an input jack for record player attachment. Has 3-position tone control. Tubes: 12AT7, 6BE6, (2) 6BA6, 6AQ5, 6AT6, 6AL5, 6X4 rectifier for 110v. 50/60 cycles AC.

1N820R—With Tubes...Shipping Weight 20 lbs.....**47.50**

HI-FI MADE EASY

with SPEAKER COMBINATION WOOFER-TWEETER $20.36

(Available Separately)

12"WOOFER

PM dynamic with 1" voice coil; 6-8 ohms impedance. 6.8 oz Alnico magnet. Capacity 14-18 watts.

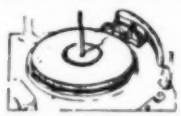
99N710R.....**5.95**

TWEETER
High Freq. Adaptor

Response over 15,000 cycles. Impedance (units in series) 6-8 ohms. Power rating 8 Watts. Supplied with mounting screen for 12" speaker. No filter network or additional space required.

22N19384R—Wt. 3 lbs.....**14.41**

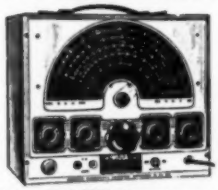
DUAL SPEED ADAPTOR



Adapts your standard 78 RPM record player for the new 45 and 33 1/3 RPM records. Kit includes speed reducing table, special pickup assembly and pickup.

34N22610R—Wt. 5 lbs.....**11.95**

FM-TV SWEEP GENERATOR



Complete FM-TV frequency coverage from 2-227 MC on 3 bands. Sweep width 500 KC to 10 MC. Dial calibrated directly in frequency. Maximum output 500,000 microvolts. Built-in power line filter. Generator output can be used either FM or pure RF. 105-125 volts, 50/60 cycles AC. Steel cabinet finished in gray wrinkle enamel. Shpg. Wt. 16 lbs.

25N21736R.....**34.95**

ELECTROLYTIC CONDENSER SPECIALS

Prong Mounting Can Type

Each 25¢ 10 for $2.25

Stock No.	Capacity Mfd.	Voltage
99N3482R	30-50/20/100	150/50/10
99N3494R	10-10/10/20	450/350/25
99N3491R	30-30-15/30	450/50
99N3469R	30/20/20	350/300/250
99N3441R	30-50/100	150/25

NEW 1950 CATALOG GOING FAST

164 PAGE BOOK
Brimful of Best Buys in

- ✓ TELEVISION
- ✓ AM & FM RADIOS
- ✓ HI-FI SYSTEMS
- ✓ PA EQUIPMENT
- ✓ ELECTRON TUBES
- ✓ RADIO PARTS
- ✓ HAM EQUIPMENT
- ✓ PHONOGRAPHS
- ✓ APPLIANCES
- ✓ TEST EQUIPMENT
- ✓ XMAS GIFT IDEAS

Plus
A BIG 16 PAGE BARGAIN SECTION

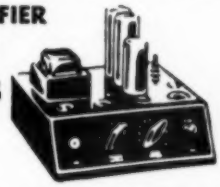
Every mail brings us hundreds of new requests for this latest and greatest Lafayette Catalog – bulging with the biggest bargains we've EVER offered in over 29 years of leadership in the radio industry. it's practically a free encyclopedia of everything new in the vast electronic field. Mail coupon for yours NOW – also start saving money at once by using the coupon to order items on this page. Remember, Lafayette's famous 30-day money-back guarantee insures your satisfaction! Get your FREE copy before this edition is exexhausted.

TYPICAL CATALOG BARGAIN HAS MANY USES

5 TUBE HIGH GAIN PRE-AMPLIFIER

5-tube, four stage preamp. Input suitable for high impedance low output pickups and high impedance mikes. Has single circuit mike jack, volume and tone control and replaceable fuse. Shipping Weight: 10 lbs.

ONLY $8.95



99N9604R—Less Tubes...**8.95**

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DON'T FORGET TO ORDER BARGAINS!

Check here for FREE Catalog (Please don't check if you already have your catalog.)

Please fill attached order. I enclose $.....in postal note, money order or check. (Include estimated shipping charges based on weight and zone. Overpayments promptly refunded).

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CITY ..... ZONE...STATE.....

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BOSTON: 110 Federal St. ATLANTA: 265 Peachtree St.

TERRIFIC VALUES IN FACTORY-FRESH, READY-TO-PLAY

TELEVISION CHASSIS

NOT KITS . . . *but completely wired custom-built* SETS

- RCA Licensed Circuits
- High gain audio amplifiers
- Improved daylight viewing
- Long range fringe reception
- Automatic picture stabilizer
- 13 channel tuning
- Factory-engineered, aligned, tested and Standard R.M.A. GUARANTEE
- The same receivers used in combinations retailing as high as $795.

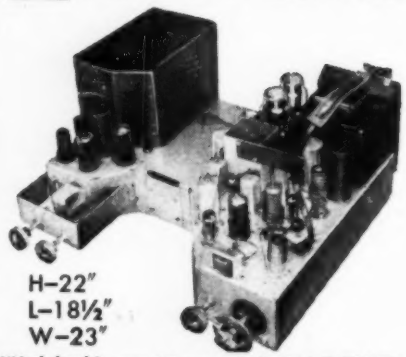
JUST PLUG IN
. . . AND IT WORKS!

H–22"; L–18½"; W–19"

C-4 **FOR 16" TV TUBE OPERATION**
(21 tubes)

less CRT **$137.50**
plus $1.80 Fed. Tax

C-3 **FAMOUS CUSTOM-WIRED 630 CHASSIS**



H–22"
L–18½"
W–23"

FOR 12½" TV TUBE OPERATION
(29 tubes)

less CRT **$155.75** plus $2.25 Fed. Tax

FOR 15" & 16" TV TUBE OPERATION
(30 tubes)

less CRT **$165.75** plus $2.25 Fed. Tax

With highly-sensitive no drift AM & FM Tuner $31.50 ea. additional plus $1.80 Fed. Tax

BRAND NEW TV TUBES AT LOWEST PRICES

10" CRT...	$19.50	12½" CRT..	$26.00	16" CRT..	$ 46.50
12" CRT...	20.00	15" CRT..	45.50	20" CRT...	189.34

AUTOMATIC RECORD CHANGERS

Webster 256-1 Dual Speed 78 & 33⅓ RPM....$28.44 incl. tax.
Webster 356-1 Three-Speed 78, 45 & 33⅓ RPM. 29.70 incl. tax.

High and Low Frequency All-Channel Antenna from $6.71 to $4.71

WHY PAY MORE ELSEWHERE?

Write Dept. M for our literature and prices—and COMPARE!

Phone and mail orders filled on receipt of certified check or money order for $25 as deposit . . . balance C.O.D., F.O.B., N. Y.

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Prices subject to change without notice.

Carl C. Brown. Mr. Brown's withdrawal was occasioned by ill health.

The principal subject discussed by the board was the NEDA Convention and Exhibition to be held August 27 through September, 1, 1950, in Cleveland. Leslie C. Rucker chairman of the convention committee, described the lecture series and other educational programs to be presented to the convention. He also emphasized the fact that the convention programs and exhibits would be open to all distributors, non-NEDA members as well as members of the association.

President Hatry appointed several new committees to serve during the 1949-50 term.

* * *

JOSEPH F. BOZZELLI has been named assistant sales manager for the *L. S. Brach Manufacturing Corporation* of Newark, N. J.

In his new post Mr. Bozzelli will supervise and direct new television antenna promotion for the company. He is a member of the IRE and has been associated with the electronics field for the last ten years.

He joined the *Brach* organization recently after serving as sales engineer with the *JFD Manufacturing Company* of Brooklyn. Prior to this time, he served as sales production manager with the *Fred Goat Co.* in Brooklyn.

Mr. Bozzelli's appointment coincides with a new television antenna and accessory program being launched by the company.

* * *

AIRCRAFT RADIO INDUSTRIES CO. of New Haven has opened a New York City office at 274 Madison Ave., Suite 1205. E. R. Jacobson is in charge. . . . **EMERSON RADIO AND PHONOGRAPH CORPORATION** has announced the beginning of manufacturing operations in Montreal, Canada. Both television and radio receivers are being produced. . . . **PHILCO CORPORATION** has started production of television receivers in its new million dollar plant in Sandusky, Ohio. The new plant will raise *Philco* capacity to 18,000 video receivers a week. . . . **JFD MANUFACTURING CO., INC.,** has moved its entire organization into the company's new plant located at 6101-6123 16th Avenue in Brooklyn. . . . **ALLEN B. DU MONT LABORATORIES, INC.,** has moved the executive offices of the receiver sales division to its recently-dedicated East Paterson, New Jersey, plant. The move affects the company's national receiver sales, advertising, and order administration departments. . . . **RAYTHEON MANUFACTURING COMPANY** has transferred the merchandising of its mobile radiophones from its *Belmont Radio Division,* Chicago, to the main plant at Waltham. The operation will be under the direction of Ray C. Ellis. . . . **SUNSET APPLI-**

(*Continued on page* 110)

YOU BUILD 'EM IN ONE EVENING BUT...

SAVE 50% WITH LABORATORY PRECISION EICO INSTRUMENTS & KITS

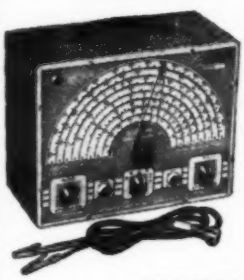
ANYONE CAN BUILD THEM!

SENSATIONAL NEW
EICO Model 360-K TV-FM SWEEP SIGNAL GENERATOR

$29.95

• Crystal marker oscillator with variable amplitude. • Covers all TV and FM alignment frequencies between 500 kc. and 228 mc. • Sweep-width variable from 0-30 mc, with mechanical inductive sweep. • Extremely wide sweepwidth allows gain comparison of adjacent RF TV Channels. • Provides for injection of external signal generator marker. • Phasing control included. • Large, easy-to-read dial is directly calibrated in frequencies. Comes complete with all tubes (including new, high-frequency miniature types): 6X5GT, 12AU7, two 6C4's. Crystal not included. 10"x8"x6¾".

FACTORY-WIRED AND TESTED
Model 360. Ready to use Sweep Signal Generator. See it at your local jobber! **$39.95**



NEW! MODEL 320-K SIGNAL GENERATOR

$19.95

For FM, AM alignment and to provide TV marker frequencies. Highly stable Hartley oscillator has range of 150 kc to 102 mc with fundamentals to 34 mc. Colpitts audio oscillator supplies **pure 400 cycle sine wave** voltage for modulation. Audio oscillator voltage can be used for testing distortion in audio equipment, bridge measurements, etc. Complete with tubes.

FACTORY-WIRED AND TESTED
Model 320. Ready to use..... **$29.95**

VERSATILE MULTI-SIGNAL TRACER

$18.95

Model 145-K. Versatile, high gain — high frequency instrument. Self-contained 5" speaker permits audible signal tracing of RF, IF, FM, audio, and video circuits. Has provision for visual tracing with VTVM. Response is well over 200 mc 3-color hammertone panel. 110-125 V. AC. Size: 10"x8"x 4¾". Comes complete with tubes and diode probe in kit form.

FACTORY-WIRED AND TESTED
Model 145. Ready to operate..... **$28.95**

5" 'SCOPE
Model 400-K

$39.95

Quality throughout! Laboratory precision scope, for FM, AM, & TV servicing. Deflection sensitivity: .65 volts per inch full gain. Linear sweep with 884 gas triode. Horizontal sweep circuit, 15 to 30,000 cycles. Frequency response of horizontal and vertical amps is from 50 to 50,000 cycles. Provision for external synchronization, test voltage, and intensity modulation. Complete with 2—6SJ7's, 2—5Y3's, 884 and 5BP1 CR tube. Graph screen for measuring peak to peak voltages. Operates on 110 to 130 volts AC, 50-60 cycles. All controls on front of handsome 3-color etched, rub-proof panel. Size 8½"x 17"x13" high. Ship. wt. 30 lbs. As with all EICO kits, easy-to-follow Pictorial and Schematic diagrams are included.

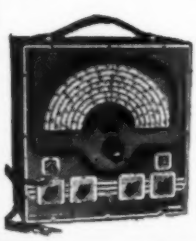
FACTORY-BUILT OSCILLOSCOPE
Model 400. The same high-quality, life-long instrument, but fully wired, assembled, and tested..... **$69.95**

HIGH-PRECISION VACUUM TUBE VOLTMETER
Model 221-K

$23.95

Tops in work bench versatility. 15 different ranges! AC and DC ranges: 0 5/10/ 100/500/1000 volts. Electronic ohmmeter ranges from .2 ohms to 1000 megohms in 5 steps. New features include Zero Center for TV discriminator alignment. DC input impedance is 26 megohms. Exceptionally accurate, big 4½" meter cannot burn out. Double triode balanced bridge circuit assures stable guaranteed performance. Sturdy portable steel case with etched, rubproof panel. 110-130 V. AC 50-60 cycle. Size: 9⅞" x 6" x 5".

FACTORY-WIRED AND TESTED
Model 221. Same, but completely wired, calibrated, and tested..... **$49.95**



DELUXE SIGNAL GENERATOR
MODEL 315

Completely wired, ready-to-use Signal Generator with 1% accuracy! A wonderful instrument with dozens of expensive features. Frequency range: 75 kc to 150 mc. Has microcycle band-spread vernier tuning for FM, AM, and TV. Voltage regulator. Write for full details. **$59.95**

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EICO Instruments and Kits are **on display** at your local jobber—the nationally advertised kits which you can see and use before you buy. You take no chances with EICO!

Prices Higher on West Coast

EASY-TO-FOLLOW SCHEMATIC & PICTORIAL DIAGRAMS

Come complete with every EICO Instrument Kit. Each kit fully guaranteed to operate perfectly when assembled according to our simple instructions!

EXCLUSIVE LIFE-TIME REPAIR SERVICE: For a nominal charge, we will repair and service your EICO instrument, regardless of its age!

ELECTRONIC INSTRUMENT CO., INC.
276 Newport Street, Brooklyn 12, N. Y.

EQUIPMENT SALE

	New	Used
BC-733D Receiver	$8.95	$3.95
R89/ARN5 Receiver	8.95	3.95
APN1 Transceiver	9.95	4.95
SCR-518 Altimeter, complete	29.50	

R·H·S
SPECIALS OF THE MONTH

Sigma Sens. Relay SPDT	$1.69
200W Power Supply Kit	16.95
Tuning Unit TU-25	1.95
3" Scope Shield	1.49

TUBES!! BRAND NEW! STANDARD BRANDS! NO SECONDS! COMPARE! TUBES!!

1B21	$ 2.87	3EP1	$ 2.69	327A	$ 2.75	848	$ .29	C100D	$ 1.95	O1A	$ .25	6A6	$ .89	6U5	$ .65	19	$ .98
1B22	3.95	3E29	8.97	338A	3.95	845	4.10	CK507AX	1.95	1A3	.44	6A7	.69	6U7G	.55	24A	.67
1B23	8.95	3FP7	1.75	350A	2.95	851	12.95	CK1005	.09	1A4	1.09	6A8	.79	6V6	.97	25L6	.53
1B24	4.69	3GP1	6.75	350B	1.89	860	5.95	CK1006	.65	1A4P	.97	6AB7	.79	6V6GT	.63	25Z5	.49
1B26	4.57	4–65A	14 49	353A	2.95	861	9.55	CK1090	2.95	1A5GT	.49	6AC7	.77	6X4	.59	25Z6	.49
1B27	8.95	4–125A	27.45	353B	7.95	864	.39	EF50	.39	1A6	.79	6AF6G	.79	6X5GT	.49	26	.57
1B29	3.49	4–250A	37.45	362A	1.95	865	1.98	F123A	12.75	1A7GT	.67	6AG5	.77	6Y6G	.67	27	.47
1B32	2.95	4AP10	4.75	368AS	3.95	866A	1.05	F125A	14.95	1AB5	.49	6AG7	.98	6Z7G	1.15	28D7	.35
1B36	4.59	4B24	3.95	371B	.69	866JR	.98	F127A	16.50	1B4	1.19	6AH6	1.29	6ZY5G	.69	30	.57
1B38	36.50	4C35	19.50	388A	2.69	869B	27.95	F128A	75.00	1B5/258	.89	6AJ5	.79	7A4/XXL	.59	31	.89
1D21	5.75	4E27	12.75	393A	3.69	872A	1.39	F606	22.50	1C5GT	.67	6AK5	.85	7A6	.67	32	.97
1N21	.95	4J32	97.50	394A	3.69	874	.39	F660	125.00	1C6	.89	6AK6	.79	7A7	.57	32L7GT	.97
1N21B	1.65	5AP1	1.95	417A	9.95	876	.29	F862A	450.00	1C7G	.89	6AL5	.65	7AG7	.72	33	.69
1N23	.79	5AP4	1.95	434A	2.95	878	1.98	FG17	2.85	1D5GP	.97	6AQ5	.89	7B4	.57	34	.69
1N23A	.79	5BP1	1.89	446A	1.25	884	1.39	FG27A	8.95	1D7G	.89	6AQ6	.59	7B6	.59	35/51	.57
1N23B	1.95	5BP4	2.69	450TH	17.95	885	1.39	FG81A	3.85	1D8GT	.95	6AT6	.47	7B7	.59	35A5	.67
1N34	.79	5CP1	1.69	450TL	37.50	902P1	3.69	FG95	17.95	1F4	.75	6AU6	.59	7C4	.37	35B5	.65
1P24	.79	5CP7	9.95	527	6.75	905	2.95	FG105	9.75	1F5G	.75	6AV6	.47	7C5	.57	35C5	.65
1R21	3.95	5D21	34.95	559	.98	908	4.95	FG172	13.95	1G4GT	.69	6B4G	.89	7C7	.59	35L6	.54
2AP1	3.69	5FP7	1.35	575A	12.69	923	.79	FT210	13.95	1G6GT	.69	6B6G	.79	7E5	.67	35W4	.39
2C21	.27	5GP1	5.95	631P1	3.75	930	.85	GL146	9.95	1H4G	.69	6B7	.89	7E6	.59	35Y4	.49
2C22	.09	5JP1	49.50	7C0A/B/C/D	19.95	931A	2.69	GL451	1.29	1H5GT	.54	6B8G	.89	7E7	.69	35Z3	.57
2C26	.19	5JP2	9.95	701A	2.95	953B	19.95	GL562	85.00	1H6GT	.87	6BA6	.55	7F7	.69	35Z4	.44
2C34	.27	5JP4	49.50	702A	2.75	954	.37	GL697	69.50	1J6GT	.89	6BE6	.57	7H7	.64	35Z5	.39
2C40	6.59	5J29	12.95	703A	3.95	955	.37	HY115	.75	1L4	.55	6BF6	.57	7L7	.69	37	.35
2C43	19.95	5J30	49.50	705A	1.10	956	.39	HY615	.25	1LA4	.79	6BG6G	1.47	7N7	.67	38	.29
2C44	9.95	5LP1	13.95	706B	18.95	957	.24	HYE1148	.37	1LA6	.89	6BH6	.57	7Q7	.59	39/44	.27
2C46	8.95	5NP1	2.89	706CY	18.75	958A	.24	KC4	49.50	1LB4	.89	6BJ6	.59	7R7	.69	41	.52
2C51	8.25	6AS6	4.95	706FY	47.50	959	.37	KU610	9.75	1LC5	.79	6C4	.25	7W7	.89	42	.49
2D21	1.17	6C21	19.69	707B	14.95	991	.24	ML100	49.50	1LC6	.57	6C5	.47	7X7	.89	43	.49
2E22	1.29	6F4	5.59	708A	3.95	1603	2.85	ML101	79.50	1LD5	.79	6C6	.57	7Y4	.57	45	.52
2E26	3.49	6J4	5.95	713A	1.09	1611	.97	ML501	69.50	1LE3	.89	6C8G	.69	7Z4	.57	45Z3	.57
2J21A	10.95	7BP7	4.65	714AY	4.95	1613	.49	ML502	89.50	1LG5	.89	6D6	.47	12A6	.59	45Z5	.49
2J22	7.95	9JP1	6.95	715B	6.95	1614	1.39	REL21	2.95	1LH4	.65	6D8G	.87	12A7	.98	46	.69
2J26	7.95	10BP4	22.50	715C	22.50	1616	.75	REL36	.59	1LN5	.67	6E5	.69	12A8GT	.59	47	.69
2J27	13.95	10Y	.49	717A	.59	1619	.17	RK21	1.59	1N5GT	.59	6F5	.47	12AH7GT	.85	50A5	.69
2J30	49.50	12DP7	12.50	721A	2.69	1624	1.10	RK23	4.85	1P5GT	.67	6F6	.65	12AT6	.45	50B5	.55
2J31	9.75	12GP7	13.95	723A/B	7.75	1625	.37	RK25	3.65	1Q5GT	.67	6F7	.85	12AU6	.67	50L6	.52
2J32	12.95	12HP7	13.95	724A/B	2.95	1626	.27	RK33	.27	1R4	.69	6F8G	.87	12AU7	.79	50Y6	.57
2J33	19.95	15E	1.29	725A	6.95	1629	.24	RK34	.27	1R5	.69	6G6G	.69	12BA6	.57	53	.87
2J34	19.95	15R	.65	726A	13.95	1630	.98	RK59	1.95	1S4	.79	6H6	.47	12BE6	.49	56	.45
2J37	12.95	23D4	.39	730A	9.95	1631	1.45	RK63	18.95	1S5	.57	6J5	.49	12C8	.49	57	.38
2J38	12.95	24G	.37	750TL	45.00	1632	.69	RK65	24.95	1T4	.57	6J6	.77	12F5GT	.58	58	.49
2J39	29.50	30 Spec	.17	800	1.75	1633	.79	RK72	.69	1T5GT	.79	6J7	.67	12H6	.27	59	.89
2J40	49.50	45 Spec	.26	801A	.29	1636	3.69	RK73	.79	1U4	.59	6K6GT	.45	12J5	.27	70L7	1.17
2J46	89.50	75TL	3.69	802	4.25	1638	.79	RX21	3.19	1V	.69	6K7	.49	12K7	.54	71A	.67
2J48	39.50	100R	1.85	803	3.49	1641	.49	RX120	8.95	2A3	.97	6K8	.79	12K8	.59	75	.53
2J49	22.50	100TH	11.50	804	8.95	1642	.27	S836	.89	2A4G	1.07	6L5	.89	12Q7	.49	76	.39
2J50	39.50	100TS	2.25	805	3.69	1665	1.10	TZ40	2.95	2A5	.69	6L6	1.17	12SA7	.57	77	.43
2J51	89.50	204A	57.50	807	1.10	1851	.97	V70D	6.95	2A6	.79	6L6GA	.87	12SC7	.57	78	.45
2J53	14.95	205B	1.75	808	1.39	1960	.89	VR65A	.98	2A7	.89	6L7	.79	12SF7	.57	80	.39
2J54B	39.50	211	.42	809	2.75	2050	.98	VR75	.89	2V3G	.99	6N7	.79	12SG7	.57	81	1.29
2J61	37.50	215A	.65	810	7.95	2051	.43	VR78	.29	2X2	.39	6Q7	.59	12SH7	.58	82	.87
2J62	37.50	217C	9.95	811	2.10	7193	.19	VR90	.65	2X2A	.69	6R7	.79	12SJ7	.49	83	.72
2K25	23.95	218	47.50	812	2.55	8005	4.75	VR105	.79	3A4	.37	6S7	.89	12SK7	.57	83V	.89
2K28	14.95	221A	1.95	812H	6.90	8011	2.25	VR150	.55	3A5	.99	6SA7	.44	12SL7	.59	84/6Z4	.63
3AP1	4.85	225	8.70	813	6.85	8012	1.39	VT127A	2.19	3B7	.35	6SC7	.59	12SN7	.52	85	.69
3B22	2.69	227A	2.95	814	2.49	8013A	1.39	VT158	14.95	3D6	.35	6SD7GT	.69	12SQ7	.49	89Y	.39
3B24	1.59	231D	1.25	815	1.35	8014A	22.50	VUT11	.59	3Q4	.59	6SF5	.49	12SR7	.49	117L7/M7	1.29
3B25	4.87	249B	2.49	816	.97	8016	1.15	WL468	6.95	3Q5GT	.67	6SF7	.59	12Z3	.79	117N7	1.37
3B26	1.79	249C	1.79	826	.39	8020	1.29	WL530	14.95	3S4	.67	6SG7	.59	14A4	.79	117P7	1.27
3B27	3.85	250R	7.45	829B	7.45	8025	4.95	WL531	7.95	5R4GY	1.10	6SH7	.49	14A7	.69	117Z3	.57
3BP1	2.95	250TH	18.95	830B	3.49	9001	.37	WL532	1.98	5T4	.89	6SJ7	.57	14B6	.67	117Z6	.65
3C23	2.47	250TL	18.75	832A	4.89	9002	.29	WL538	2.25	5U4G	.57	6SK7GT	.55	14E7	.69		
3C24	.37	274B	1.05	833A	34.45	9003	.33	WL578	1.29	5V4G	.89	6SL7GT	.65	14F8	.89		
3C30	.34	294A	4.57	834	5.75	9004	.37	WL616	87.50	5W4	.79	6SN6GT	.97	14H7	.65		
3C31	3.95	304TH	3.75	836A	.97	9005	1.95	WL619	19.95	5X4G	.59	6SN7GT	.65	14N7	.59		
3C45	12.95	304TL	1.39	837	1.69	9006	.24	OA2	1.57	5Y3GT	.37	6SQ7	.45	14Q7	.57		
3CP1	1.49	305A	24.95	838	2.45	C5B	6.95	OA4G	.95	5Y4G	.49	6SR7GT	.57	14R7	.67		
3D21A	1.95	307A	3.75	841	.35	C6A	7.95	OB2	1.75	5Z3	.49	6SS7	.59	15	.89		
3DP1	5.95	316A	.84			C6J	3.95	OZ4	.57	5Z4	.79	6T7G	.98				

OIL CONDENSERS
ALL RATINGS DC

.25	mfd	600v	$ .37	1	mfd	2000v	$1.07
.5	mfd	600v	.37	2	mfd	2000v	1.47
1	mfd	600v	.37	4	mfd	2000v	3.77
2	mfd	600v	.37	8	mfd	2000v	3.97
2x2	mfd	600v	.77	15	mfd	2000v	4.95
4	mfd	600v	.57	.1	mfd	2500v	1.45
6	mfd	600v	.97	.25	mfd	2500v	1.77
8	mfd	600v	1.07	.5	mfd	2500v	1.98
10	mfd	600v	1.27	.05	mfd	3000v	1.75
.25	mfd	1000v	.47	.25	mfd	3000v	2.65
.5	mfd	1000v	.57	.5	mfd	3000v	2.75
1	mfd	1000v	.67	1	mfd	3000v	2.98
2	mfd	1000v	.77	2	mfd	3000v	3.47
4	mfd	1000v	1.37	4	mfd	3000v	4.45
8	mfd	1000v	1.97	12	mfd	3000v	6.97
10	mfd	1000v	2.07	1	mfd	4000v	4.25
15	mfd	1000v	2.47	2	mfd	4000v	4.85
20	mfd	1000v	3.27	3	mfd	4000v	5.45
.5	mfd	1500v	.77	1	mfd	5000v	4.98
1	mfd	1500v	.97	4	mfd	5000v	5.45
2	mfd	1500v	1.17	.1	mfd	7000v	2.97
4	mfd	1500v	1.77	1	mfd	7000v	5.97
24	mfd	1500v	5.47	.01	mfd	7500v	2.45
.1	mfd	2000v	1.07	.02	mfd	7500v	2.75
.25	mfd	2000v	1.17	.03	mfd	7500v	2.97
.5	mfd	2000v	1.27	1	mfd	7500v	6.95
				.02	mfd	12000v	9.97

HIGH CAPACITY CONDENSERS
ALL RATINGS DC

2x3500	mfd	25v	$3.47	200	mfd	35v	$ .57
2500	mfd	3v	.35	100	mfd	50v	.45
3000	mfd	25v	2.45	4000	mfd	18v	1.95
2x1250	mfd	10v	1.27	4000	mfd	30v	3.25
1000	mfd	15v	.98	2350	mfd	24v	2.25
				10000	mfd	25v	4.57

TRANSFORMERS—115 V. 60 Cy.
HI-VOLTAGE INSULATION

6350v @ .025 arms	$12.95
2500v @ 4 ma; 6.3v @ 1A; 2½v @ 2A	5.97
2500v @ 15 ma. $4.29 2100v @ 10 ma	3.97
1700v @ 4 ma; 6.3v @ 1A; 2½v @ 2A	4.98
1600v @ 4 ma; 700v CT @ 150 ma; 6.3v @ 9A	4.97
1500v @ 7 ma; 2.5v @ 1.75A	4.47
525-0-525v @ 60 ma; 925v @ 10 ma; 2x5v @ 3A; 6.3x @ 3.6A; 6.3v @ 2A; 6.3v @ 1A	6.97
500-0-500v @ 175 ma	4.95
500-0-500v @ 25 ma; 262-0-262v @ 55 ma; 6.3v @ 1A; 2x5v @ 2A	4.45
425-0-425v @ 75 ma; 5v @ 3A; 6.3v @ 1.5A	3.98
400-315-0-100-315v @ 200 ma; 2.5v @ 2A; 5v @ 3A; 2x6.3v @ 9A	5.95
385-0-385-550v @ 200 ma; 2.5v @ 2A; 5v @ 3A; 3x6.3v @ 6A—pri 110/220	6.27
385-0-385v @ 70 ma; 2.5v @ 10A; 5v @ 6A; 5v @ 3A	4.95
340-0-340v @ 300 ma; 1540v @ 5 ma	4.95
600v CT @ 100 ma; 5v @ 2A; 12½v @ 2A; 12½v @ 3A	3.37
300-0-300v @ 65 ma; 2x5v @ 2A; 6.3v @ 2½A; 6.3v @ 1A	3.47
255-0-255v @ 240 ma; 325-0-325v @ 12 ma	4.98
120-0-120v @ 50 ma	.97
80-0-80v @ 225 ma; 5v @ 2A; 5v @ 4 ma	3.49
36v @ 15A $0.95 24v @ 10A	4.47
18v @ 15A 8.95 13.5v CT @ 3.25A	2.47
12.6v CT @ 10A; 11v CT @ 6.5A	6.95
12v CT @ 10A; 2x9v CT @ 10A	7.49
3x10.3v CT @ 7A	6.95
8v CT @ 1A	.97
6.3v @ 21½A; 6.3v @ 2A; 2½v @ 2A	4.45
6.3v @ 12A; 6.3v @ 2A; 115v @ .1 amps	3.45
6.3v @ 10A; 6.3v @ .6A	2.47
6.3v CT @ 3.5A; 2x2.5v @ 3A	2.97
6.5v @ 8A; 6.5v @ 5A; 5v @ 3A; 2.5v @ 1.75A	4.45
6.3v @ 1A; 2.5v @ 2A $2.25 6.3v @ 1A	.77
5v @ 20A; 10KV ins. 9.97 .6v @ 15 arms.	1.77
5v @ 3A; 2.5v @ 2A. 2.97 2.5 @ 10A	3.97

SELENIUM RECTIFIERS
Full Wave Bridge Type

INPUT		OUTPUT		
up to 18v AC	up to	12v DC	½ Amp.	$1.47
up to 18v AC	up to	12v DC	1 Amp.	1.97
up to 18v AC	up to	12v DC	5 Amp.	5.27
up to 18v AC	up to	12v DC	10 Amp.	8.97
up to 18v AC	up to	12v DC	15 Amp.	11.57
up to 18v AC	up to	12v DC	30 Amp.	22.57
up to 36v AC	up to	28v DC	1 Amp.	3.47
up to 36v AC	up to	28v DC	5 Amp.	8.57
up to 36v AC	up to	28v DC	10 Amp.	14.57
up to 36v AC	up to	28v DC	15 Amp.	22.27
up to 115v AC	up to	100v DC	.25 Amp.	2.57
up to 115v AC	up to	100v DC	.6 Amp.	5.27
up to 115v AC	up to	100v DC	5 Amp.	22.57
up to 115v AC	up to	100v DC	3 Amp.	17.97

FILTER CHOKES
HI-VOLTAGE INSULATION

10 hy @ 400 ma.	$ 5.97	1 hy @ 800 ma.	$14.97
15 hy @ 70 ma.	1.17	10 hy @ 250 ma.	2.47
12 hy @ 150 ma.	3.47	10 hy @ 200 ma.	1.98
30 hy @ 60 ma.	1.37	.0/20 hy @ 85 ma	1.57
.05 hy @ 15 amps.	7.97	15 hy @ 125 ma.	1.47
.1 hy @ 5 amps.	6.97	15 hy @ 100 ma.	1.37
4 hy @ 600 ma.	5.97	3 hy @ 50 ma.	.27
200 hy @ 10 ma.	3.47	30 hy dual @ 30 ma	1.47
600 hy @ 1 ma.	3.17	3/30 hy @ 250 ma	3.47
325 hy @ 3 ma.	3.47	/2 hy @ 175 ma.	1.49
3.5 hy @ 400 ma.	6.75	14 hy @ 40 ma.	6.75
6 hy @ 400 ma.	6.97	60 hy @ 50 ma.	6.97

PHONE DIGBY 9-0347

PRICES SUBJECT TO CHANGE WITHOUT NOTICE
All Merchandise Guaranteed
F. O. B. New York City. Minimum Order $5.00
20% Deposit Required

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0B3/VR90	.87	2C39	18.00	5W4	.74	6S7G	.85	12AH7GT	.56	43	.57
0C3/VR105	.75	2C40	3.75	5X4G	.71	6S8GT	.79	12AT6	.45	45	.27
0D3/VR150	.49	2C43/464A	8.91	5Y3GT	.38	6SA7GT	.45	12AT7	.79	45,VT52	.27
0Z4	.87	2C44	1.69	6A3	.81	6SB7Y	.81	12AU6	.59	46	.65
C1A	3.25	2C51	6.45	6AC7	.74	6SC7	.65	12AU7	.89	48	1.56
01A	.25	2D21	.90	C6A	6.95	6SD7GT	.45	12AV6	.59	50	1.49
1A3	.59	2E5	.89	6A3	.98	6SF5	.55	12AV7	.89	50L6GT	.79
1A4	1.26	2E22	1.34	6A4	1.29	6SF7	.78	12BA6	.56	EF50	.45
1A5GT	.70	2E24	3.98	6A6	1.02	6SG7	.83	12BA7	.89	50B5	.54
1A6	1.26	2E25/HY65	2.98	6AF7M	.75	6SH7	.38	12BD6	.59	50C5	.59
1A7GT	.89	2E26	3.45	6AB	.78	6SJ7GT	.55	12BE6	.45	50L6GT	.56
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1J6	.79	3A4	.36	6BH6	.79	7AF7	.70	14N7	.85	HY115/145	.80
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1T4	.54	4C33	81.00	6H6	.63	7J7	.65	31	.36	304TL	1.39
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1U4	.69	4D32	7.98	C6J	4.75	7L7	1.09	FG32	4.98	316A	.38
1U5	.69	4J31	95.00	6J4	4.95	7N7	.86	32L7GT	.95	327A	2.90
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2B4	.98	5D21	27.90	6L5G	.98	7Y4	.49	35Z5GT	.41	394A	3.75
2B7	1.39	5J29	17.39	6L6	.98	7Z4	.63	REL36/6J4	.75	FP400	7.98
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450TL	49.95	927 CE2S	1.26	12KP4	34.75						
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RH507	9.98	955	.18	902	3.75						
527	3.37	956	.18	905	3.80						
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GL534/1621	1.95	991	.49								
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701A	3.50	1624	1.69	4A1	1.29						
702A/702B	3.20	1625	.37	6-11	.49						
703A	3.75	1626	.35	9X12	.49						
704A	1.08	1629	.26	PMB	.98						
705A 8021	1.05	1632	.89	9-3	.49						
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710A 8011	6.85	1635	1.49	13-4	.49						
713A	1.49	1641 RK60	.68	20-4	.49						
715B	7.29	2050	.95	K49A	.36						
717A	.81	2051	.42	K55B	.36						
721A	2.85	5514	4.85	K55C	.36						
722A/287A	9.95	5515	5.85	L62A	.49						
723A	6.95	UX6853	5.69	K80B	.36						
723A/B	14.95	8012A	1.45	WL1121A	2.61						
724A/B	3.90	8013A	2.50	C37G	2.98						
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804	6.90	9005	.50	64 Each	.07						
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810	7.90	3AP1	4.75	313/28V	.15						
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812	2.98	3BP1A	7.98	Slyvania 56							
813	8.98	3CP1	2.65	6W/120V	.15						
814	2.61	3CP1-S1	2.49	Watghs C7							
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836	.98	5BP1	1.98	NE16/991	.25						
837	2.35	5BP4	4.50	NE32	.35						
838	3.29	5CP1	1.75	NE45/NW	.24						
842	2.75	5CP7	7.50	NE51 NE30	.07						
843	.38	5FP5	4.75	**DIALCO TYPE**							
845	4.15	5FP7	1.26	Bull's Eye Pilot Lite Complete W/ 56-115V bulb or Neon Bulb Chromed 2 for 98c							
851	14.95	5FP14	18.85								
860	2.39	5HP1	4.95								
861	10.75	5JP1	21.50								
864	.45	5JP2	11.75								
865	.95	5LP1	18.00								
866A	1.04	5LP5	18.00								
866Jr	1.00	5LP7	18.00								
868,PJ23	1.90	5MP1	3.89								
869	30.00	7BP7	4.65								
872A	1.49	7CP1	12.95								
874	.58	7HP7	5.95								
876	1.95	9GP7	12.33								
878	1.95	9LP7	2.21								
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885	1.39	12DP7	12.49								

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2x.5	.13	1	1.09	.1	2.89
2x5	.59	2	1.69	1	7.98
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1	.15	2x.1	.79	2	19.98
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.1	.23	.1	.89	.0016	4.98
.2	.25	1	1.27	**16000WVDC**	
.25	.31	2	1.98	.05	5.29
.5	.33	3	3.49	**25000WVDC**	
1	.35	4	3.98	.00025	4.95
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10	1.15	8	8.98	**AC Cndsrs**	
2x.05	.09	2x.1	1.08	**330vac/1000dc**	
2x.25	.20	**2500WVDC**		1.25	.55
2x.1	.27	.25	.74	2	.65
2x2	.55	7	2.75	3	.85
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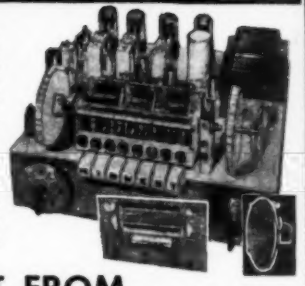

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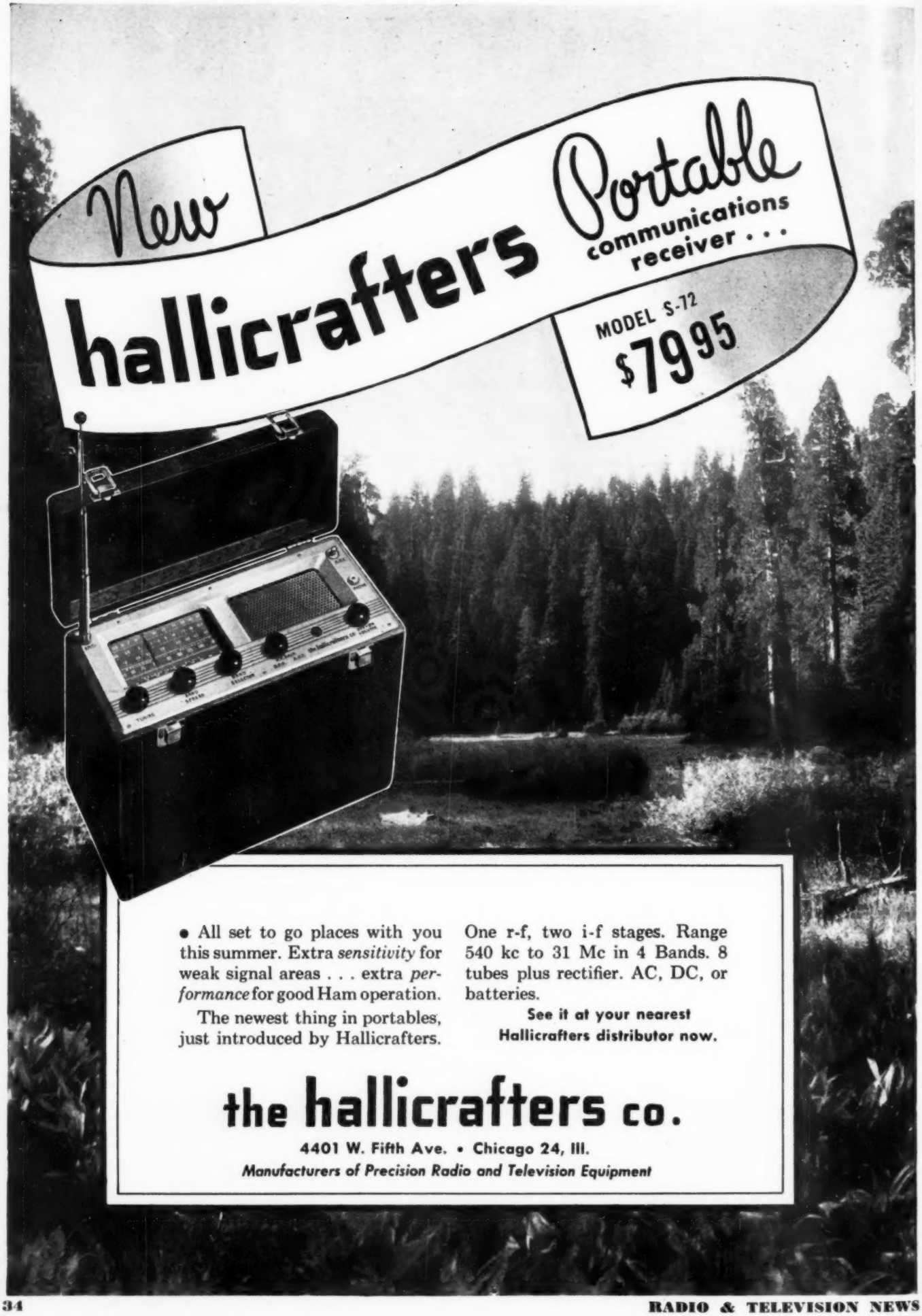

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Fig. 1. The internal construction of the RCA three-color television pickup camera unit.

COLOR TELEVISION?

By
M. S. KAY

A review of RCA and CBS color systems. Will either of these or some other color system be chosen? Decision is, at present, in hands of FCC. It is likely that final decision will be postponed indefinitely to permit further design development and improvement.

EVERYONE knows that someday all television will be color television. Of this, there is little doubt or dispute. The big question at the moment, however, is When? Is color television ready now or are we technically premature? Can color television be made compatible with our present black-and-white system or will it require an entirely new set of standards, thereby obsoleting all present sets? It is for the purpose of finding answers to these questions before the final u.h.f. allocations are made that the present hearings are being conducted by the Federal Communications Commission.

One of the most important stipulations that was made by the FCC concerning the adoption of any color television system was that it should be as nearly compatible to our present black-and-white system as possible. It is definitely not desired that the 2,500,000 or more sets now in the hands of the public be made obsolete by the introduction of a color television system.

The two major systems that are receiving the most consideration are those put forth by *RCA* and *CBS*. The *CBS* system is essentially the same one developed and demonstrated by this firm several years ago. The *RCA* system, however, is entirely new.

Color Fundamentals. To start at the beginning, let us investigate a few facts about color. Color, physicists tell us, is a property of light. If we take sunlight and pass it through a glass prism, a variety of colors are produced. White sunlight contains all colors but, due to the limitations of the human eye and the fact that the colors produced by the prism blend into each other, we can count only seven fairly distinct colors. Upon closer inspection of this color distribution, innumerable fine gradations may be distinguished, both between different colors and within any one color itself. For example, red when it first becomes definitely distinguishable from its neighbor, orange, possesses a different shade than it does at the other end of the red band, where the infrared wavelengths are approached.

Now all the various shades and tints that are contained in the spectrum can be reproduced by combinations of three pure colors. The colors are red, green, and blue and these have been named the "primary" colors. To obtain a certain color, we combine the primary colors in definite proportions. Yellow may be derived from combinations of red and green; orange by other proportions of the same two colors; white by using all three, etc. These facts

have been put to use in color television by breaking down the light received from a scene into its primary components at the transmitter and then recombining them at the receiver.

RCA System

In the *RCA* system, the scene to be televised is picked up by a color camera containing three camera tubes. The light entering the camera is passed through special mirrors (known technically as dichroic mirrors) which possess the property of being able to reflect one color but pass all others. Thus, a red dichroic mirror will reflect red light, but permit all other light to pass through. In the color camera, red and blue dichroic mirrors are arranged in the manner shown in Fig. 1. The portion of the incoming light which is red is reflected by the red dichroic mirror (and a second reflecting mirror) into one camera tube. The blue portion of the incoming light is reflected into a second camera tube by the blue dichroic mirror (and a second reflecting mirror). What remains of the light after passage through the two dichroic mirrors, green, is received by the third camera tube. In this manner every bit of light reaching the camera is sorted into its primary color components.

The output from each camera is now transferred through separate low-pass filters (which pass only video signals having frequencies up to two megacycles) to an electronic sampling tube. See Fig. 3. At the same time this is happening, portions of the three-color signals from the camera are combined in electronic Adder No. 2 and passed through a bandpass filter where video frequencies up to 2 mc. are suppressed and those from 2 to 4 mc. are transmitted. This system of dividing the color signals into separate low- and high-frequency components and then combining all of the high-frequency components together is known as a mixed-high system. Why this particular method was chosen will be indicated presently.

The mixed-high frequencies are fed to Adder No. 1 which is also receiving signals from the electronic sampler. However, while the mixed-high frequencies are arriving in a continuous stream, the low-frequencies are arriving in spurts, from the electronic sampler, in the form of short pulses. Within the sampler, an electron beam is revolving at a rate of 3.8 million times per second. The beam thus comes in contact with the color signal from each camera 3.8 million times in each second providing Adder No. 1 with this many samples from each color, one sample arriving every 0.263 microsecond ($1/3.8 = 0.263$). Fig. 4 shows the output of the sampler for a short period of time. In Fig. 4A, the output of the sampler for the green signal is shown. A green sample (pulse of voltage from the signal fed to the sampler by the camera receiving the green portion of the incoming light) appears every 0.263 microseconds.

At a time 0.0877 microsecond after the first green sample, a sample is taken of the voltage from the camera receiving the red rays of light. The red samples themselves, however, are spaced 0.263 microsecond apart. Blue samples are taken at the same rate as the red and green samples and appear 0.0877 microsecond after a red pulse of voltage. The composite sequence of these voltage pulses is shown in Fig. 4D. For any particular scene, the strength of each pulse would depend, of course, on the amount and shading of the color rays reaching the camera.

The pulses at the output of the sampler tube are fed to Adder No. 1 where they are combined with the mixed-highs signal. Both signals are applied now to a low-pass filter (passing 0-4 mc.) where the pulses of voltage from the electronic sampler are smoothed out. Each of the smoothed out pulses now becomes a sine wave having a frequency of 3.8 mc. See Fig. 4E, F, and G. It should be noted in these sine waves that when any one color signal reaches its maximum value, the other two color signals are passing through zero. This is important and insures that when the signals are again sampled at the receiver, that only one color is obtained during each sampling.

While the three sine waves are shown separately in Fig. 4E, F, and G, they are actually combined in the low-pass filter to form the composite signal shown in Fig. 4H. It is this composite signal which combines with the mixed-highs signal to provide the complete video signal. The remainder of the transmitter now follows the usual sequence of amplifying this voltage, impressing it onto an r.f. carrier and sending it out over the air to the receiver.

Color Television Reception. The color television signal at the receiver (together with the accompanying sound) is received and amplified by a series of stages which, up to the second detector, are similar in all respects to the same stages found in present black-and-white television receivers. Thus, there is an r.f. amplifier, a mixer, a high-frequency local oscillator, a series of video i.f. stages and a conventional second detector. See Fig. 5. The same is true of the audio system with its i.f. amplifiers, discriminator, audio amplifiers, and speaker.

Now, the video signal at the output of the second detector consists of the

Fig. 2. Block diagram of a possible two-color TV receiver.

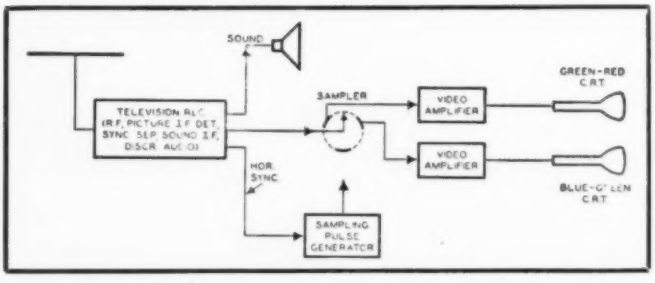


Fig. 3. Block diagram of RCA's color television transmitter.

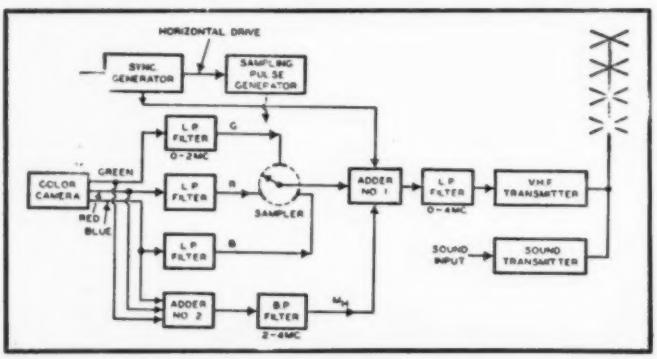
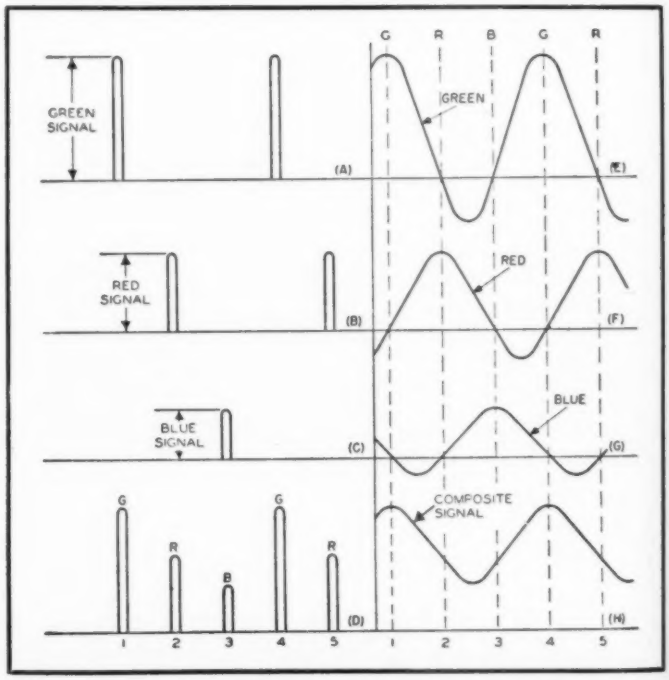


Fig. 4. Method of operation employed in the sampler system.



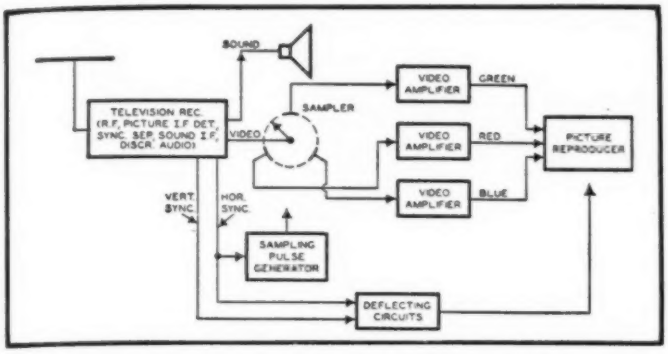


Fig. 5. A block diagram of a color television receiver.

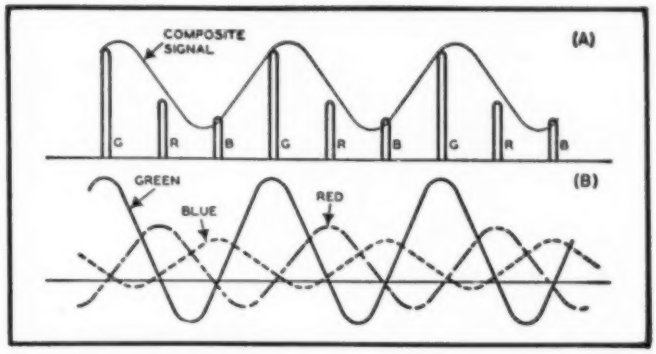


Fig. 6. Operation of the receiving set sampler system.

composite color signal, as shown previously in Fig. 4H, plus the vertical and horizontal synchronizing pulses which are required to keep the receiver image in step with the transmitter image. Part of the signal is applied to a sync separator stage where the sync pulses are divorced from the rest of the signal and then fed to saw-tooth deflecting circuits where they lock-in the sweep oscillators. This, again, does not differ from conventional black-and-white television receiver practice.

The rest of the signal from the video second detector is fed to a sampler tube which is similar to the sampler tube employed at the transmitter. Every 0.0877 microsecond, the sampler tube samples the composite signal, producing the narrow pulses shown in Fig. 6A. The amplitude of each sample will depend upon the strength of the composite wave at that particular instant. This same stipulation was true at the transmitter, it will be remembered.

The sampler sends these pulses to each of the video amplifiers and its associated cathode-ray tube in succession. Thus, looking at Fig. 6A, the green pulse goes to the video amplifier system which is associated with the cathode-ray tube emitting green light, the red pulse goes to the red video system, and the blue pulse goes to the blue video system. The sequence then repeats itself, going from green, to red, to blue for as long as the equipment is in use. To insure that the sampler tube sends the series of pulses to the various video amplifiers in proper sequence, the trailing edge of the horizontal synchronizing pulse is used to drive both receiver and transmitter sampler tubes.

When the three colored pulses pass through their respective video amplifier systems, they are smoothed out to the sine wave form shown in Fig. 6B. Note that while all of the signals are shown together in this illustration, only the green signal goes to the green cathode-ray tube, only the red signal goes to the red cathode-ray tube, and only the blue signal goes to the blue cathode-ray tube. The image that is produced on each cathode-ray tube will thus depend upon how much of the scene being sent by the transmitter contains that particular color. If, for example, there is a considerable amount of red detail in the scene, with little blue and say slightly more green, then the amount of detail visible on each separate image tube will vary accordingly. The light output of all tubes are combined then to form the complete picture, to provide the true shading of the original scene.

In the receiver shown in Fig. 5, the total signal consisting of the sampled signal plus the mixed-highs has been inserted in the receiver sampler and when this unit samples portions of the incoming signal, it obtains for each pulse the proper low frequencies for that color plus a combination of the mixed-highs.

Consider carefully what happens to the high frequencies. At the transmitter these high-frequency components of each color were combined, first with each other, and then with the low-fre-

Fig. 7. RCA color TV direct-view picture-reproducing system using 3 kinescopes and two dichroic mirrors.

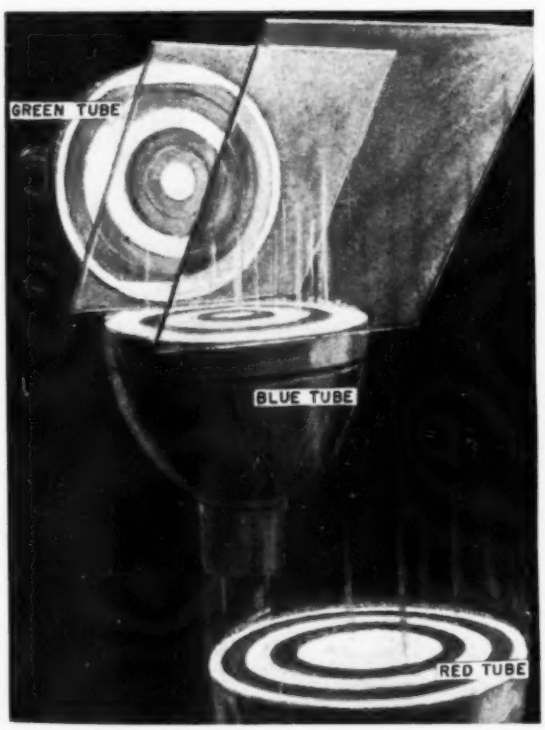
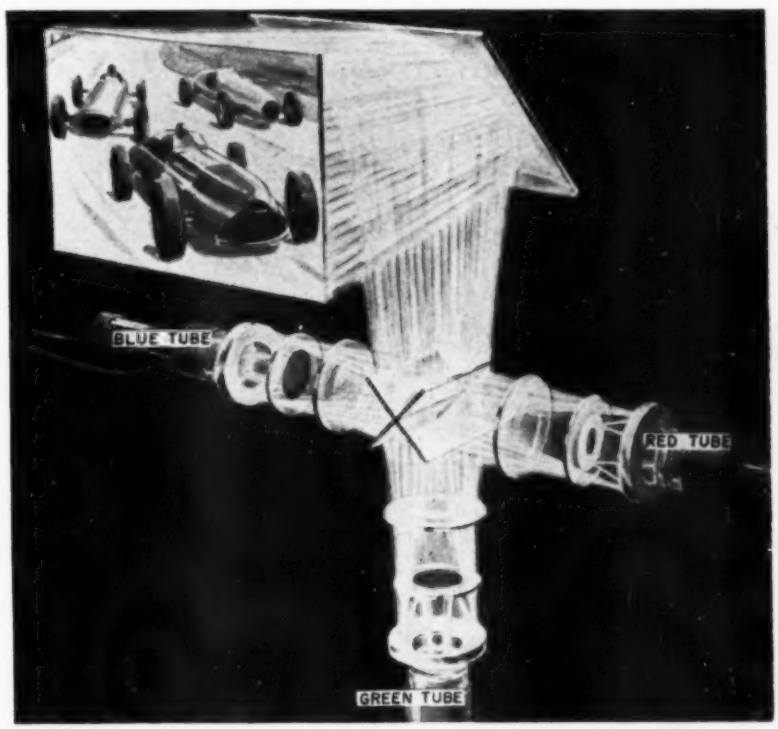


Fig. 8. RCA color television projection picture-reproducing system using three projection kinescopes, reflective optics, and two dichroic mirrors.



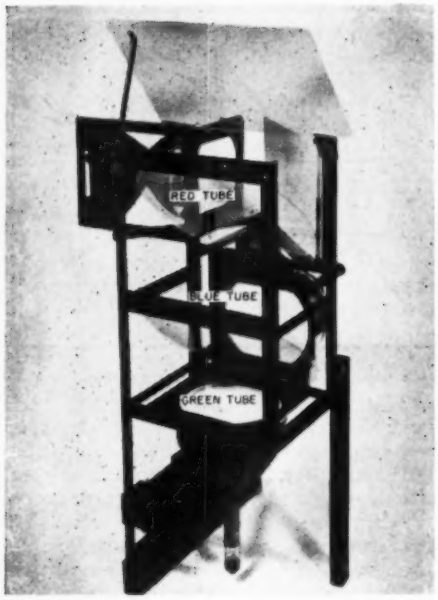


Fig. 9. Another way of combining the three colored image tubes.

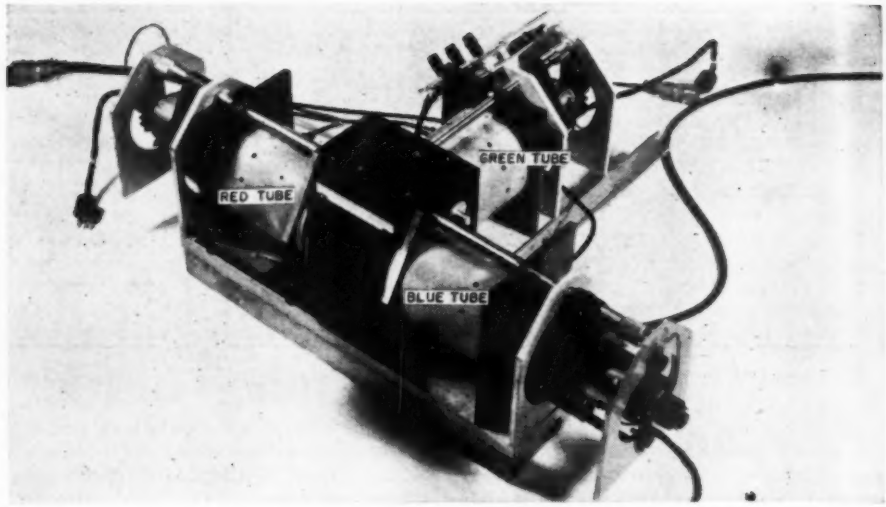
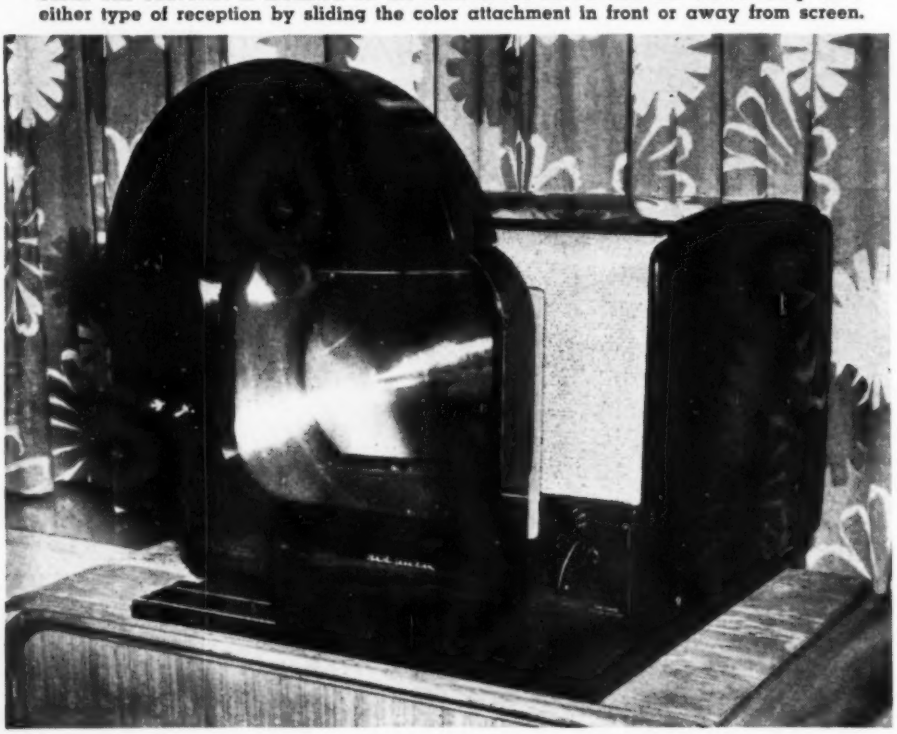


Fig. 10. Arrangement of projection tubes and their optical system.

quency composite signal obtained from the output of the sampler. At the receiver, when the electronic sampler samples the signal, it will obtain not only the particular color wanted, say blue, green, or red, but in addition, it will also receive a combination of the high-frequency components of all three colors at the same time. Thus, each cathode-ray tube will have its own color plus essentially the same highs or fine detail. Since each image tube receives the same amount of fine detail, the combination of these three colors in the final image will produce either white, black, or intermediate shades of grey. This is because the combination of the three primary colors, in equal amount, will produce white or its equivalent. Thus we see that in a "mixed-highs" system, the fine detail of the image will appear in monochrome, and the larger detail will be in color.

The "mixed-highs" system is similar to the process of color rotogravure used in printing newspapers and periodicals. To print a color photo, the three primary colors are used, with the addition of a fourth plate which is black. This fourth plate adds black, white, and the intermediate shades of grey to the image formed by the three primary colors. It has been found that through the use of this fourth plate, the depth, emphasis, and richness of the picture are increased. The same results are observed in television.

Fig. 11. A television color converter, constructed by CBS. With a simple adapter built into the set, it enables a black-and-white television receiver to pick up color broadcasts. The converter is mounted on the front of the set so that the viewer may have either type of reception by sliding the color attachment in front or away from screen.



Reception with Black-and-White Receivers

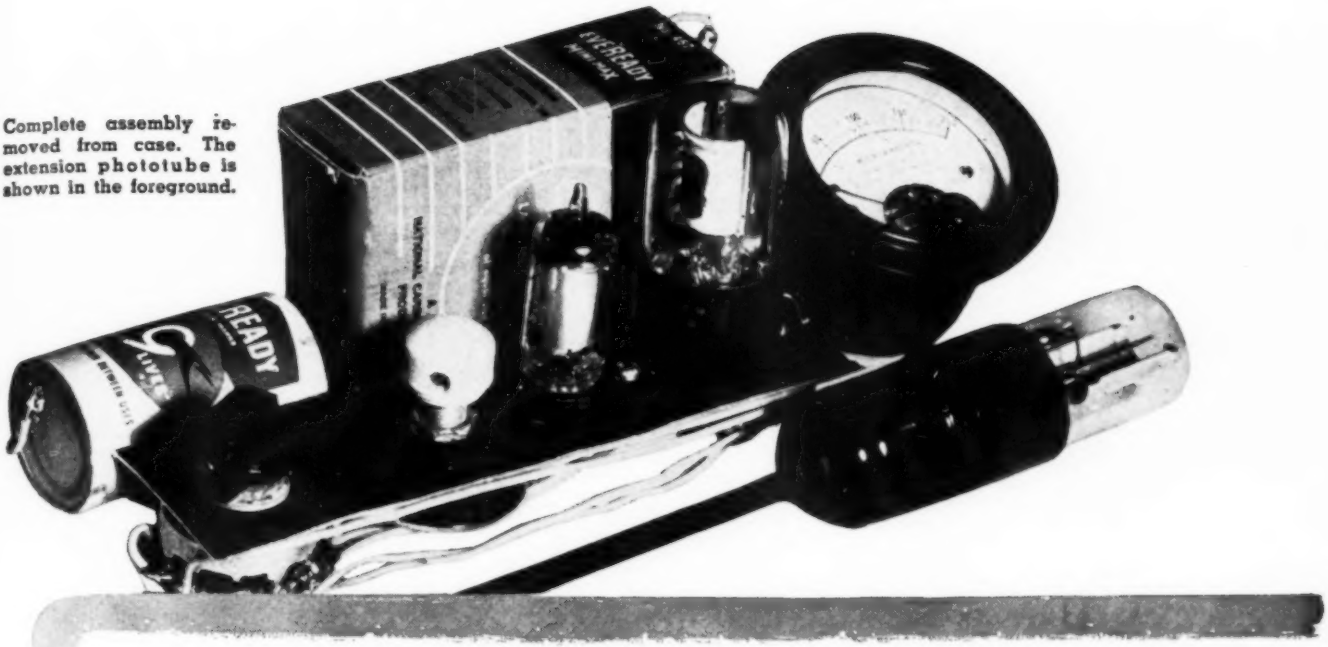
The signal which is radiated by the color transmitter consists of a composite voltage obtained by combining the low-frequency components of each color with the mixed-high components. The total signal, therefore, possesses all of the information needed to develop a black-and-white image with full resolution. When a black-and-white receiver is tuned to a color broadcast station, the total signal, after the video second detector, is passed through several video amplifiers and then applied to a conventional cathode-ray tube. It is true that there is a 3.8 mc. sine wave superimposed on the picture signal due to the 3.8 mc. sampling frequency at the transmitter. This will produce a dot pattern on the black-and-white image tube in highly colored areas, but the dots are not noticeable at normal viewing distances.

When a color receiver is tuned to a television broadcasting station transmitting a black-and-white signal, the picture will appear in black and white with full resolution on the color receiver screen. The successive pulses delivered to the three image tubes will all be of equal magnitude, and, hence, will produce varying intensities of white—which represents a normal black-and-white picture.

Color Receivers and Color Converters

A color receiver requires three image tubes plus some method of combining their images to produce the single final color picture which is viewed by the observer. Fig. 7 illustrates one method of combining these tubes using cathode-ray tubes which are similar electrically to present image tubes except that the phosphorescent screen of each is designed to produce either a red, green, or blue image. These images are then viewed through two dichroic mirrors. The red

(*Continued on page* 102)



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By GLEN SOUTHWORTH

A light intensity meter twenty to forty times more sensitive than conventional exposure meters.

PHOTOGRAPHY is quite similar in its general aspects to the field of sound transmission and playback, both of these being chiefly concerned with the reproduction of two separate physical sensations. A number of common objectives are shared, such as accuracy of reproduction, emphasis of desirable effects, and speed and convenience in recording and processing. As a result, it is not surprising that many radiomen express interest in the field of photography, particularly in those instances where such electronic devices as the electronic phototimer, stroboscope, and speed flash are useful.

A simple and flexible device, valuable in other fields as well as in photography, is the electronic photometer to be described in this article. Using few components, it may be quickly and easily constructed for approximately one-third the cost of commercial exposure meters, and it has the strong advantage of being twenty to forty times more sensitive; thus, it can be utilized in a number of applications for which the conventional unit is unfitted.

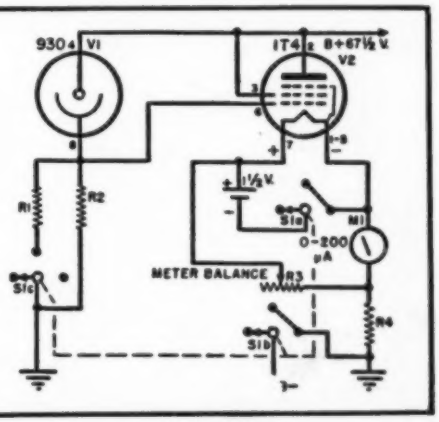
Basically, the unit consists of a gas or vacuum type photocell and a sensitive vacuum tube voltmeter. For simplicity and portability, the power supply consists of a miniature "B" battery and a single 1½ volt flashlight battery. The vacuum tube voltmeter is a simple one-tube circuit designed for minimum battery drain. Readings are essentially linear, and sensitivity is full scale at one volt or less, making this an excellent circuit for a compact portable test instrument.

Total "B" current drain is of the order of two to four milliamperes, while "A" battery drain is slightly more than fifty mils, giving fairly long life to both batteries. This should approximate about a hundred hours of use for the "B" battery and five to ten hours for the "A." The more expensive "B" battery may be kept in service even at voltages as low as forty-five volts and still obtain serviceable results. The bucking current for the meter is obtained from the positive side of the "A" battery, thus eliminating the need for a separate bias battery.

The photocell shown in the schematic is a Type 930, an inexpensive tube of high sensitivity, developing approximately 135 microamperes per lumen and is commonly used in sound and relay work with an incandescent light source. For more precise work, vacuum type photocells, such as the 929 which has a sensitivity of forty-five microamperes per lumen, may be used. In applications where extreme sensi-

(*Continued on page* 101)

Complete schematic of sensitive photometer circuit. A one milliampere meter may be used if desired. Additional range may be secured through masking of the phototube.



R_1—1 megohm, ½ w. res.
R_2—10 megohm, ½ w. res.
R_3—1500 ohm wirewound po.
R_4—1500 ohm, ½ w. res.
S_1—3 pole, 3 pos. rot. sw. (Mallory 3243J)
M_1—0-200 microammeter
1—1½ v. battery
1—67½ v. battery
1—1T4 tube
1—930 tube

DON'T Sell "Nuts and Bolts"

By
CARLE CHRISTENSEN
Sales Consultant

In presenting the technical features of a receiver, be sure you stress what they mean in terms of enjoyment and performance to the prospect—do not give just a technical explanation of how it works.

To the non-technical customer—sell the enjoyment a TV set will offer.

A YEAR or two ago, very little sales effort was required of the average radio dealer. The pent-up, post-war demand was sufficient to move all the radios and appliances he could get, and there was no serious competition either as to quality or price. It was not a matter of being able to sell the prospect—it was a question of how much the prospect could buy from the dealer.

As we all know, however, the picture has changed. Each day brings us new problems of competition, both as to quality and price, and where in the past, salesmanship was an unnecessary frill in the dealer's operation, today it makes the difference between success and failure.

As was pointed out in a previous article, "The Buying Motives, Key to More Sales" (August, 1949, issue, RADIO & TELEVISION NEWS), people buy something because they feel it can fulfill one or more of their desires. In selling to the average person, there is very little in the way of cold, hard thinking that enters into the process. True, you may explain how the article you sell operates, but it will be helpful *only insofar as it appeals to or awakens one or more of the prospect's desires to possess it.* Technical explanations that go beyond this do not help the sale, and if the prospect is not able to understand or appreciate your explanation, it may "kill" the sale.

It is especially important that the salesman with a technical background keep this in mind, because many of the sales that he loses to the trained salesman are forfeited because he sells "nuts and bolts," or should we say "coils and condensers," instead of what his product could do to fulfill the desires of the prospect.

Perhaps the best way to demonstrate what we have in mind is to consider the sales presentations of two television dealers—one who sold the prospect and the other who didn't.

Our prospects, Mr. and Mrs. Thomas Black, decided they wanted to buy a television receiver. There were two radio dealers in their immediate neighborhood, and as we join them, they have just entered the shop of the first dealer, whom we will call Mr. Jones. After the usual greetings, Mr. Black has said, "We're interested in buying a television receiver. I've noticed you have some on display. We'd like a demonstration."

Our salesman, happy at the prospect of a sale, replies, "Yes, indeed. Come right this way, won't you? Here's my very finest set. It has twenty-eight tubes, with a separate channel for both audio and video signals, a twelve-inch cathode-ray tube, and a twelve-channel tuner with a stage of preselection, ratio detection, and push-pull 6L6's in the output. Isn't she a beauty?"

Mr. Black, smiling faintly, replies, "Yes. It does look nice, but that all sounds like Greek to me. I had no idea it was so complicated. You see, I don't know a thing about radio; I'm an accountant."

Mrs. Black, who really wants a set very much, senses her husband's objection and suggests, "But Tom, it can't be so difficult. Mabel Jordan operates theirs all the time." Then turning to the dealer, she asked, "Will you please explain to us how to tune it?"

"Yes indeed, Mrs. Black. It's very simple. You just turn the a.c. switch like this and let the set warm up. Then you turn the volume control up about half way, and turn the tuner indicator to the channel you want. Then you adjust the vernier control, set the brilliance and contrast controls, and there's your station. Simple, isn't it?"

Mr. and Mrs. Black looked at each other a bit bewildered, and then Mr. Black answered, "Yes, I guess it is when you know how, but it still seems rather complicated. Do you have any sets that are easier to operate?"

"Oh, no, Sir. They are all just about the same in that way. No trick at all when you get on to it. Any more questions you'd like to ask?"

Mr. Black, with a doubtful expression, answered, "No, not just now, Mr. Jones. I guess we'll want to think it over a little. Thank you for your trouble."

"That's O.K.," nodded the dealer. "Drop in any time. Be glad to serve you."

Outside the store, Mr. and Mrs. Black walked along quietly for a time. Then Mrs. Black spoke, "But Tom, I still can't believe it is as complicated as he said it was." There was another period of silence, and then with marked determination, she added, "And if Mabel Jordan can do it, I can do it too! Let's drop in at the other store down the street and see what they say. Maybe they'll have some simpler sets."

Tom Black grinned broadly. "O.K., Kitten, let's give him a try."

Inside the second store, Mr. Black made the same request for information. The clerk, as before, was prompt and courteous in his reply. "Yes, Sir. I'll be very happy to show you some of our sets. Here's a set we're really enthusiastic about. It will give you a brilliant, large, easy-to-view picture of approximately 75 square inches. That's really ideal for the average living room and makes it comfortable for eight to ten people to enjoy themselves.

"The receiver embodies all of the latest engineering features to insure you a brilliant, steady picture from all stations, and because of its superior design, it's as simple to tune as your present radio. Let's try it, shall we?

"Here's a program listing for today. Let's see now, it's just about 7:30 p.m. Oh, yes. Here we are—what would you like? There's a dramatic show at Number 4 on the tuning dial, a news broadcast at Number 5, an old western movie on Number 7 and a night baseball game on Number 9.

"Number 9? All right, Mr. Black. Now just to show you how simple it is, I want you to tune it for me.

"First of all, let's turn the set on with the knob that is labeled 'Volume.' That's just like the volume control on your regular radio. It turns the set on, and later, when you want to control the volume, you just turn it to the left or to the right depending on how loud you'd like it.

"Now, we'll give the set just a few moments to warm up. That's just like your radio too, isn't it? In fact, there really isn't very much difference between the two, except that in this set you tune in the picture as well as the sound.

"Next, let's turn the tuning dial to station Number 9. There we are. See, we're getting a picture already. We can do a little better than that, though. See this second knob in the center of the tuning dial? That's the fine adjustment that enables us to tune the set *exactly* to the station. We just turn it *slowly* until we get the loudest sound. You'll notice, that as you tuned in the loudest sound, the picture got brightest too, didn't it? Actually, we tune them both in at the same time, with just one knob—we tune in the sound and the picture takes care of itself.

"That's really a fine picture you tuned in, isn't it, Mr. Black?" continued the dealer after a few seconds. Mr. Black was beaming like a school boy who'd hit his first home run.

The dealer, quick to crystallize this positive emotion into a definite picture, suggested, "Just like being at the ball game, isn't it? Can't you just picture yourself, relaxed in a comfortable arm chair, watching the World Series? There's really nothing like it. All the magic of modern science at your finger tips. Golly, look at that hit! He really walloped that one, didn't he?"

Meanwhile, Mrs. Black was still a bit cautious. This was such a contrast to the first demonstration. And there *were* two more knobs. Waiting for the opportune time, she asked, "But what about the two other knobs? Don't you have to adjust them, too? I've been given the idea that tuning a television receiver was a lot more complicated."

"Oh, I was going to explain those to you in just a moment, Mrs. Black, but the fact is, because of the superior engineering of this set, you won't have to adjust them very often. Actually, they are in some ways like the tone controls on your radio. Perhaps you remember that some

A television receiver has tremendous appeal for everyone. In making your sales presentation, keep technical details at a minimum and build your sales talk around the pleasure and enjoyment it will bring the family as a group, or individually.

radios had one control for the high tones and another for the low tones? Well, that's just about what these are, except that they control the picture. Now, you come over here and turn the one marked 'Brilliance.' There! You see how much brighter the picture became? Now, turn this other knob marked 'Contrast.' Notice how the picture became darker and the contrast between the light and dark shades became greater? Well, you adjust those two controls to get the most pleasing picture. And as a general thing, they will require very little attention from one station to the next. Now *you* tune in a station for us, Mrs. Black. Let's see about that dramatic show on Channel 4."

Quickly and easily, under his expert coaching, she tuned in the program.

"There, now, isn't that something? A dramatic theater in your own home. Can't you just see yourself and your friends gathered together around this television receiver? It's almost hard to understand how we got along without it, isn't it?

"Do either of you have any further questions?"

Mrs. Black guessed she didn't, but Mr. Black, returning to the world of reality, asked about the price.

"Well, Mr. Black, figured over three years of use, this set will cost you only about thirty cents a day—not much doubt about your getting that much entertainment out of it, is there?

"In fact, you'll find it will actually save money over what you are now spending for movies, plays, and sports events and, besides, it will bring you a whole world of

(*Continued on page* 118)

Both photographs are of the same receiver, yet to the general public, one is a maze of resistors, coils, and condensers, while the other is a thing of beauty, a complete TV set capable of bringing limitless pleasure and enjoyment to the happy owner. Which has the greater appeal? Which do you sell?

Adding Phone To "YOUR FIRST TRANSMITTER"

The transmitter described in the August issue may be easily converted for phone operation by the addition of a modulator.

The added modulator acts as a convenient base for the present transmitter.

By R. L. PARMENTER, W1JXF

IF YOU have already built up the little rig previously described in these pages as "Your First Transmitter" (August, 1949, issue) and you have a desire to incorporate phone operation, it is a relatively simple matter to accomplish this.

Utilizing a quite simple circuit and requiring few parts, the small modulator herein described has its output applied to the screen circuit of the 807 final amplifier. More than enough power is obtained from a 50B5 miniature beam pentode to superimpose on the carrier emitted by the 807 the amplitude modulation required for phone operation. Since a portion of the 160 meter band is now available for use by all classes of amateurs, the combination provided by the addition of this unit to the r.f. section makes an ideal rig for around town use. The author has worked across town consistently even through evening QRM with entirely satisfactory results. It may be possible to get satisfactory operation on 10-meter phone by using a 10-meter crystal, or by using a 20-meter crystal and doubling in the 807 stage. The author has not tried this and the results cannot be guaranteed, but the possibilities seem to be there since the 807 requires so little drive.

In the event this is tried, however, it is advisable to check the harmonic radiation of the transmitter, especially if there are television receivers in the vicinity. Even a small harmonic content will cause interference to television receivers, and possibly result in quiet hours in order to keep peace with the neighbors.

The various radio publications have had several articles in recent months on the subject of eliminating television interference, and it is suggested that these articles be studied if such interference is encountered. In many cases, the interference may be cured by the use of r.f. chokes in series with the power line feeding the transmitter. The use of an antenna system resonant to the operating frequency will help in some cases.

In severe cases, the only solution may lie in the shielding of the transmitter. This procedure is described in the September, 1949 issue of RADIO & TELEVISION NEWS.

The circuit consists of a single stage of voltage amplification for building up the output from a single-button microphone and applies this to the grid of a beam power pentode. This, in turn, applies audio power to the screen of the r.f. final. This is really an adaptation of a screen modulation circuit previously described in these pages where it was used to modulate an 813 final.[1] The voltage gain has been decreased and the power output reduced. Also an a.c.-d.c. type of rectifier, along with the series string for filament heating, has been used to eliminate the need for a power transformer. Contrary to what may have been expected, there were no difficulties experienced from hum troubles. The only disadvantage apparent so far is the fact that an actual earth ground cannot be used either on the modulator or the r.f. final, and, consequently, the chassis ground is at the potential of one side of the line. Allowance must be made for this fact, of course.

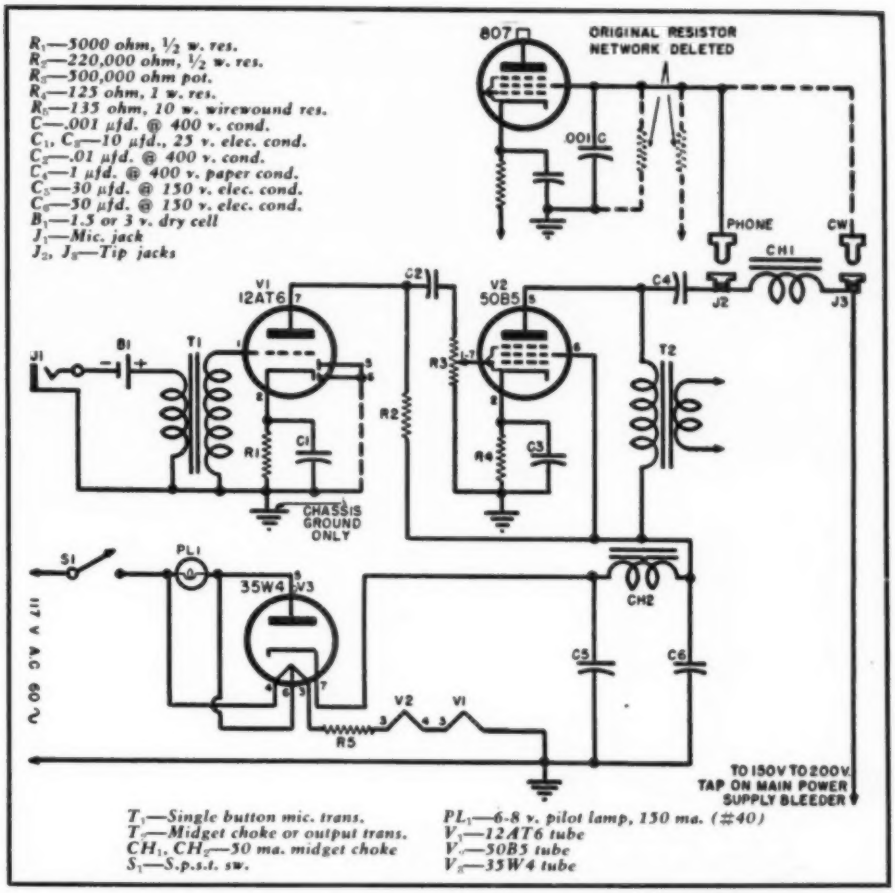
The coupling arrangement between the modulator and the 807 is accomplished by the use of midget chokes and is in reality Heising modulation applied to the screen. This system was not uncommon in the old days of modulated oscillators but applied to the plate circuit. Almost any choke heavy enough for the average small table model radio is good enough for this job, as the impedance matching is

[1] "Screen Grid Modulation," Alva Wilson, W5DAD. RADIO & TELEVISION NEWS, November, 1948.

not critical. One choke furnishes a plate load for the 50B5, while the other furnishes additional filtering for the screen voltage and keeps the audio power from being lost in the power supply. The 1 μfd. paper condenser passes the audio voltage from the plate of the 50B5 to the screen circuit of the 807 but blocks the screen voltage from the 50B5. This condenser could be larger in capacitance, but this is really not necessary since the 50B5 develops ample audio power. A 35W4 is used as a half-wave rectifier to supply d.c. for the other tubes.

It was deemed desirable to keep the height of the unit to a minimum since it was to be used as a base for the transmitter proper. By using a 7x7x 1½ inch chassis, inverted, we were able to conserve some height and at the same time retain the use of the front and back drop for mounting controls and terminals. The chassis is raised above the baseboard of the cabinet by 1-inch machine screws which act as legs. This provides usable space below the chassis for socket wiring and for accommodating the smaller items, such as resistors, cathode condensers, and coupling condensers. A box was made of wood and Masonite, the inside dimensions being 7¼x7½x3¼ inches. This is used to house the chassis; the r.f. portion slides down into the side pieces of Masonite and are affixed together by flathead 6-32 machine screws.

A top view of the chassis is shown in the photo, and while the parts placement is not especially critical, it is advisable to orient the chokes so that their fields will interact as little as possible. The cylindrical object at the front of the chassis is a war surplus microphone transformer. Wiring below chassis is done point-to-point, and it was not deemed necessary to illustrate this. The microphone battery is connected by using two banana jacks, while the two combination binding posts on the backdrop of the chassis are for cutting the modulator in or out of the circuit (for c.w. or phone). The manner of doing this is shown in the circuit diagram.



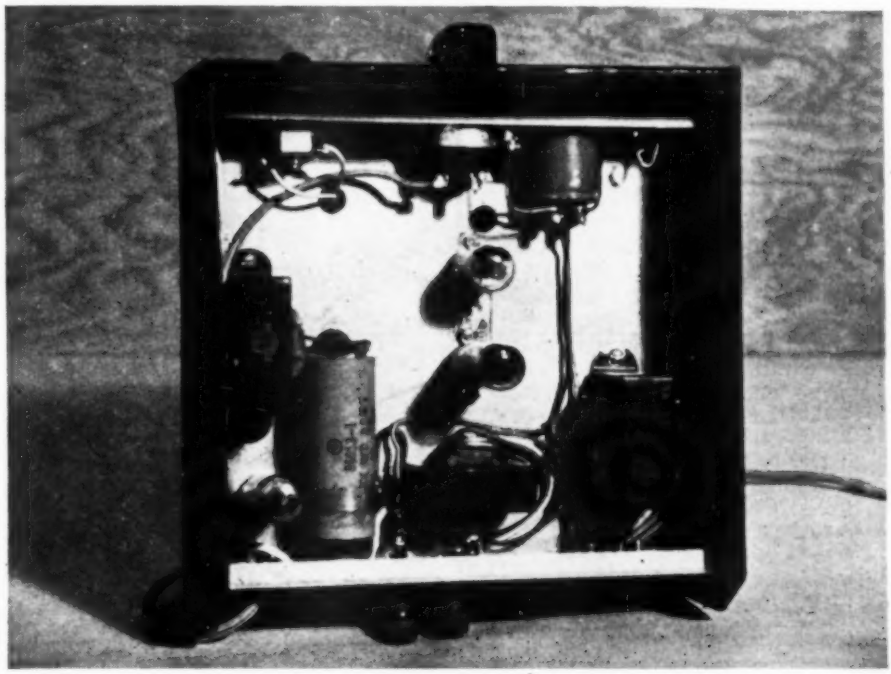
Schematic diagram of the modulator, showing the changes in screen wiring.

Operation

After the unit has been built and the wiring checked, it may be tested for audio gain and quality by connecting a pair of phones across the binding post marked "for c.w." and the ground, with no other external connections being made. (In other words, the unit is not connected to the transmitter.) A very small amount of gain is required to provide an astonishing amount of pickup. If this test proves satisfactory, it may be connected to the transmitter and put on the air. Modulation may be observed by a Christmas tree bulb in a feeder or by the neon indicator. Upward modulation must be maintained, so do not load beyond the point where this occurs since it is easy to overmodulate. Some means of checking for percentage of modulation should be employed, even if it is merely having the neighboring amateur listen in for your signal. Plenty of gain was observed at our station when using a T17B hand mike (war surplus) and a 1½ volt dry cell, and the quality reports were satisfactory for communications purposes.

This little modulator provides an easy, economical way of applying phone to the small c.w. rig previously described. It may be effectively employed with other transmitters, of course, when the power requirements are similar or somewhat higher. We ran into no "bugs" in its construction or operation, and it should present no difficulties even to a beginner. —30—

Top view of the modulator. All components are below the chassis.



CATHODE FOLLOWER Matches Audio Line

By
LEON G. WILDE

An inexpensive method of matching a 250 or 500 ohm line without a plate-to-line transformer. This system also provides power circuit control over the same line.

WHEN recently the writer had occasion to couple a phonograph preamplifier to an amplifier 30 feet distant, a cathode follower circuit was used to give low impedance, saving the cost of an expensive tube-to-line transformer and at the same time achieving excellent high-frequency response. Ordinary twisted pair, such as is used by the telephone company, was employed for the transmission line, although a shielded cable such as *Belden* 8401 is also suitable for the purpose.

The circuit diagram for a typical cathode follower circuit and an accompanying chart giving parts values for various tubes to match 250 ohm and 500 ohm lines is shown in Fig. 1. Where the value of R_2 is given as zero, it may, of course, be omitted, and the junction of R_1 and the grid resistor grounded. The purpose of C_1 is to block d.c. from the line, preventing the terminating resistor from shunting the cathode for d.c. It may be an electrolytic providing that polarity is observed as shown in Fig. 1.

Care should be taken not to overdrive these circuits. About 2 volts r.m.s. can be used without excessive distortion. The grid resistor may be replaced with a 500,000 ohm potentiometer if desired, and this used to adjust the input level.

Parts placement is no more critical than in other audio circuits. The input circuit may be well-shielded to prevent hum pickup, as the degenerative effect of the cathode follower circuit will reduce the effects of any reasonable amount of shield capacity.

A balanced 500 ohm line may be fed by using two 250 ohm circuits hooked "back-to-back" in push-pull, and the line terminated with two 250 ohm resistors whose junction is grounded. A 6SN7 fits this application admirably.

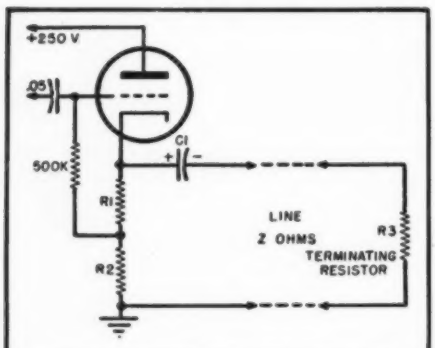
Although in the application already mentioned, the volume and tone were controlled at the remote amplifier, the circuit might also be used to couple a preamplifier containing volume and tone controls to a remote power amplifier. In a case such as this, the circuit of Fig. 2 can be used to turn the amplifier on and off from the preamplifier using the same wires used to transmit the audio intelligence.

In this circuit, when the preamplifier power is turned on, a d.c. voltage from the preamplifier "B plus" circuit is fed through R_1 to the line, operating the relay through the 10,000 ohm resistor. When the relay closes, it completes the power circuit of the remote amplifier and turns it on also. The audio is transmitted through the 50 μfd. blocking condensers to the 500 ohm terminating resistor. Note that in this case the polarity of the blocking condenser connected to the 6SF5 cathode is opposite from that shown in Fig. 1. In this case, the d.c. control voltage on the line is greater than the 6SF5 cathode voltage, hence this connection. To prevent the inductance of the relay coil from affecting the frequency response of the line, it is isolated by means of the 10,000 ohm resistor. The value of R_1 and the voltage rating of the 50 μfd. condensers will depend upon the relay used.

The relay should be a fairly sensitive unit. The one used by the writer was a 7500 ohm, 28 volt surplus unit, and operated on about 3 ma. After the relay has been decided upon, the value of R_1 can be found by connecting the 10,000 ohm resistor, the relay, and successively smaller trial values of R_1 across the "B" supply until a value is found for R_1 such that the relay just closes. If the characterisitcs of the relay are known accurately, then the value of R_1 may be calculated. Next measure or calculate the voltage drop across the 10,000 ohm resistor and the relay combined, allow a safety factor, and use this value for the voltage rating of the 50 μfd. condensers. If the relay contacts will not handle the primary current of the amplifier power supply, then the sensitive relay may be connected to operate a larger 117 volt a.c. relay having adequate contacts.

These circuits should find application in any case where the use of a high-impedance circuit will result in unsatisfactory frequency response. Because for relatively short distances (in the order of 50 feet) almost any type of cable may be used, it is often possible to use existing cables, thereby saving the expense and inconvenience of installing new cable. The control circuit of Fig. 2 adds a control function without extra wiring, gaining further simplicity and convenience. —30—

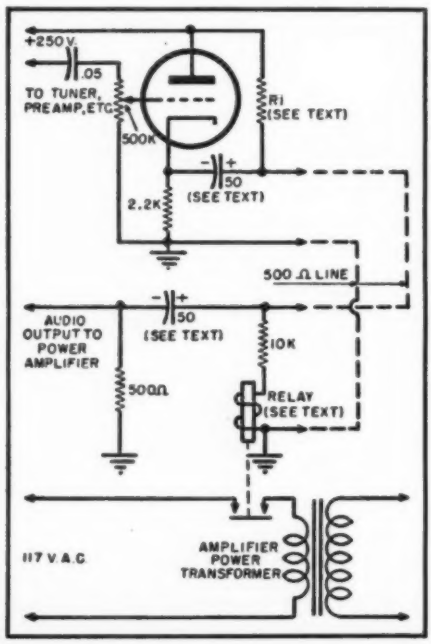
Fig. 1.



TUBE	R_1	R_2	R_3	Z	C_1	GAIN
6SF5	2200	0	500	500	50	.38
½6SL7	820	1800	500	500	50	.40
6J5 ½6SN7	820	0	250	250	100	.33

R_1, R_2, R_3 in ohms, ¼ watt; C_1 in μfd., 25 w.v.

Fig. 2.



NEW MARKETS for INTERCOMS

By ARIE LIBERMAN
Pres., Talk-A-Phone Co.

Almost 90 per-cent of the potential intercom market is untapped. Add this profitable line to your business.

MOST versatile yet least familiar of electronic products distributed through merchandising outlets is the intercommunication system. This combination of utility and mystery offers not only a tremendous market, but a real challenge as well. If ever there was a free field in the electronic industry, intercom offers it.

To begin with, consider just one facet of the intercom market: the home. Research tells us that fewer than one-half of one per-cent of America's homes are intercom-equipped.

While the industrial and office intercom market has received rather more attention, a conservative estimate of the sales potential in the intercom field as a whole would reveal that fully ninety per-cent of the market is virtually untouched.

Why is this so, in an age when other electronic products have made such thorough penetration of their markets? First, because intercoms, particularly home installations, are only beginning to catch the popular imagination; because demand has not yet been created, and most basic reason of all, because its sale appears to be a complicated procedure. Note that I say "appears to be." In reality it is very simple.

Let's see what happens when the prospective buyer decides that he wants an intercom. First, he has recognized a specific need. Actually, he usually is not fully aware of how much can be accomplished with an intercom. He merely knows he has a problem and he hopes that an intercom can solve it for him. Were he aware of the versatility of the intercom, if he knew in how many ways intercoms could be used to coordinate his organization or simplify the operation of his home and eliminate wasted time and energy, he would be in a better position to explain his needs comprehensively to the salesman. But in most cases he is unaware of the full field of usefulness of an intercom.

The radio distributor and service technician, on the other hand, knows all these things about intercoms, but he is not familiar with the prospect's problem. And no matter how many questions are asked, the first contact may not reveal exactly what is needed. This is the crucial point in intercom selling. The technician can overwhelm the prospect with his technical knowledge of intercoms and usually smother the sale in his own erudition, or he can ask a few simple, basic questions which will instill and justify the customer's confidence and lead to an acceptable solution of his problem. After these basic questions are asked, upon the "salesman" rests the responsibility of recommending equipment which will first meet the prime requirements of the prospect and second, make way for the additional intercom setup which he will eventually need, or the need for which he is presently unaware.

At this point, the salesman will avoid recommending a complicated system. Instead he will take the prospect step by step over the basic principles of the intercom. Let's assume that the installation calls for several master units and additional staff stations, where one staff station is to originate calls, another is not to originate calls, another is to be "private" and still another "non-private." To enumerate the needs in this way would be to needlessly confuse the prospect. Fortunately, the manufacturer himself has come to the rescue by devising a versatile and flexible product, a unit which can give the buyer master stations where he needs them; staff stations as required; horns or boosters; in short, everything needed in any given situation, bearing in mind future as well as present needs.

Probably the manufacturer's greatest contribution to simplified selling of intercoms has been the introduction of

(*Continued on page* 136)

PRINTED CIRCUITS

Part I. A review of printed circuit techniques. To be concluded next month with an article on how the experimenter can apply, in a simplified form, printed circuits to home constructed units.

By

JOHN T. FRYE

This typical group, only a few of the many commercially built units already produced, is an example of how Centralab's printed circuit audio amplifier has been received by the industry.

A VERY loud *Bang* announced to the electronic world early in 1945 that printed circuits had moved from the experimental to the practical stage, for it was at that time that the National Bureau of Standards, working closely with the *Centralab-Division* of the *Globe Union Company,* began mass production on the tiny radio proximity fuse for mortar shells: a fuse incorporating a complex electronic circuit "printed" on a thin steatite plate 1¾" long by 1¼" wide!

Since that time, the printed circuit has thrust its tentacles into every portion of the electronic field, and it has miraculously shrunk everything it touched. Hearing aid amplifiers, complete with batteries, that are smaller than a cigarette package; personal radios that can be cradled in the palm of the hand; radio and television subassemblies occupying only one-tenth the space needed for conventional assemblies and requiring one-half as many soldered connections for installation: these are but a few of the achievements of this new process, and the surface has barely been scratched. Every day sees new applications of this method by which space is saved, weight is reduced, assembly is simplified, and cost is cut.

Every electronic worker is certain to come in contact with printed circuits in increasing number, and it is the purpose of this article to prepare him for that contact by making him familiar with the various methods and techniques by which these circuits are produced commercially and then showing him how he can develop and experiment with his own printed circuits.

First, it should be clearly understood that the term "printed circuit" covers any reproduction of an electrical circuit upon an insulating surface by any process. Essentially it changes a bulky three-dimensional array of electrical parts and conductors into a compact and very nearly two-dimensional arrangement. An example best shows how this is done:

Suppose we want to build the complete interstage coupling circuit shown in Fig. 2. First, let us redraw our diagram on a tiny plate of steatite approximately 1"x¾". Then let us carefully trace out the heavy lines with a small brush which we have dipped into a "paint" made by mixing fine particles of silver together with a liquid binder to hold the particles together and a solvent used to make the mixture thin enough to brush.

Next, suppose we have several different solutions of finely powdered graphite or lamp-black, a resin binder, and a solvent. We can experiment with these until we find just the right combination of mixture, thickness, and length of line needed to produce resistances equal to R_1 and R_2; and then we carefully paint in these resistance lines at the proper points between the silver conducting lines already drawn. Then we place our little plate in an oven and raise the temperature to the point where our lines of paint will be "fired" directly to the ceramic base, adhering to it with a tensile strength of 3000 pounds to the square inch. Finally we solder tiny ceramic condensers of the proper values across the gaps representing the condensers, and then we attach flexible leads to our silver paint at points 1, 2, 3, and 4. The result is a "printed circuit" that will perform exactly the same as one

Fig. 1. The "Couplate" unit. It contains a complete interstage coupling circuit.

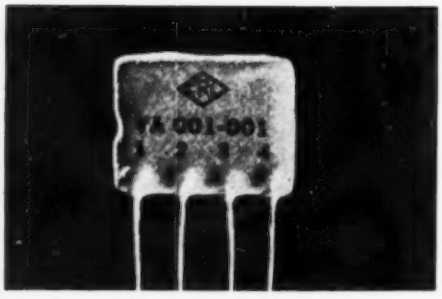
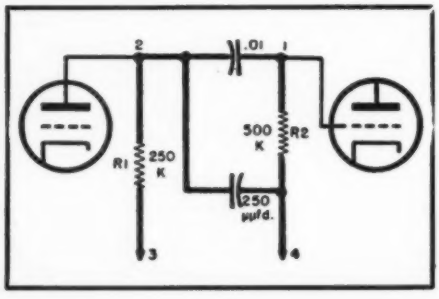


Fig. 2. Diagram of "Couplate." Finished unit measures 1-1/16 x 13/16 x 3/16 in.



using conventional components, but our printed sub-assembly will be no bigger than a postage stamp and require only four soldered connections to be made by the radio assembly-line operator. A commercial version of just such a printed circuit is shown in Fig. 1.

Such a manual process, while pointing up the difference between printed and conventional circuits, obviously could not be adapted to mass production. Various stencilling methods are the answer to producing more uniform circuits at higher speed, and the silk-screen process is one of the most successful.

In this system, a fine-meshed silk screen is tightly stretched on a wooden frame and covered with a photosensitive material that becomes insoluble when exposed to strong ultraviolet light. A photographic-positive mask of the exact shape of the required conducting circuit is placed on top of the screen, which is then exposed to the rays from an ultraviolet lamp. Finally, the portions of the film protected by the mask are washed away in cold water, leaving a stencil of the conductor design to be printed. All four of these steps are clearly illustrated in Fig. 3.

This finished stencil is held securely against the base plate to be printed; and the circuits can be printed on practically any insulating material, or even on conducting material that has been coated with a non-conducting film, such as lacquer, and a quantity of silver paint is placed at one end of the screen. A neoprene bar, or "squeegee," is moved across the top surface, forcing the paint ahead of it and down through the open mesh of the design, as is shown in Fig. 4. When the screen is removed, the surface of the plate is found to be printed with an exact, sharp-edged, uniformly-thick design of the required conductor circuit. A second stencil can be used to print the resistors in their proper places. The paint is fired to the base exactly as was done before. This process is shown in Fig. 6. In Fig. 7 are displayed base plates at various stages of completion.

Brushing and stencilling with a silk

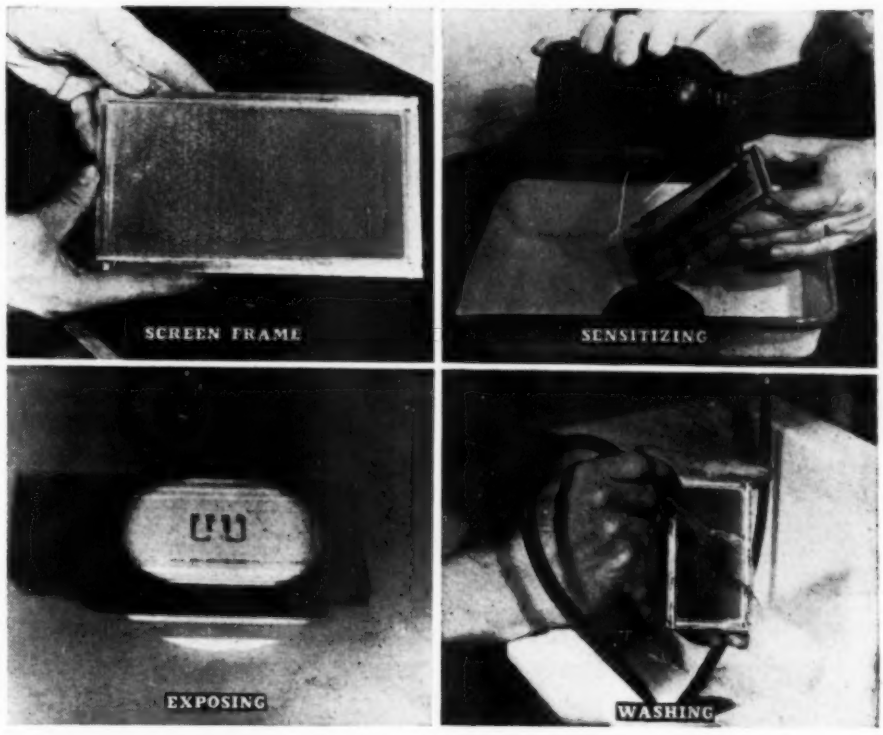


Fig. 3. These individual operations show the method used in preparing a silk screen.

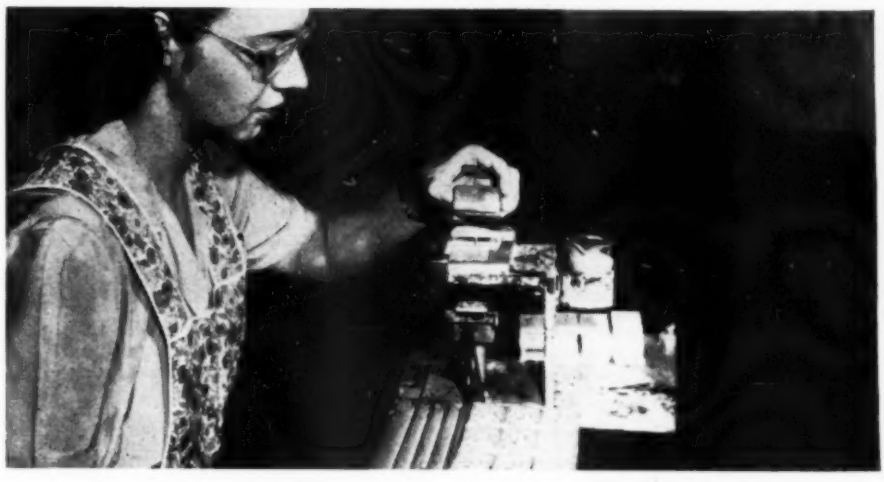


Fig. 4. Silk-screen printing. Paint is forced through the open mesh of the screen. After the screen is removed, the surface of the base plate is found to be printed with an exact, sharp-edged, uniformly-thick design of the required conductor circuit. A second stencil can then be used to print the resistors in their proper location.

Fig. 5. Front and rear views of one of the many hearing-aid amplifiers that are printed on ceramic plates.

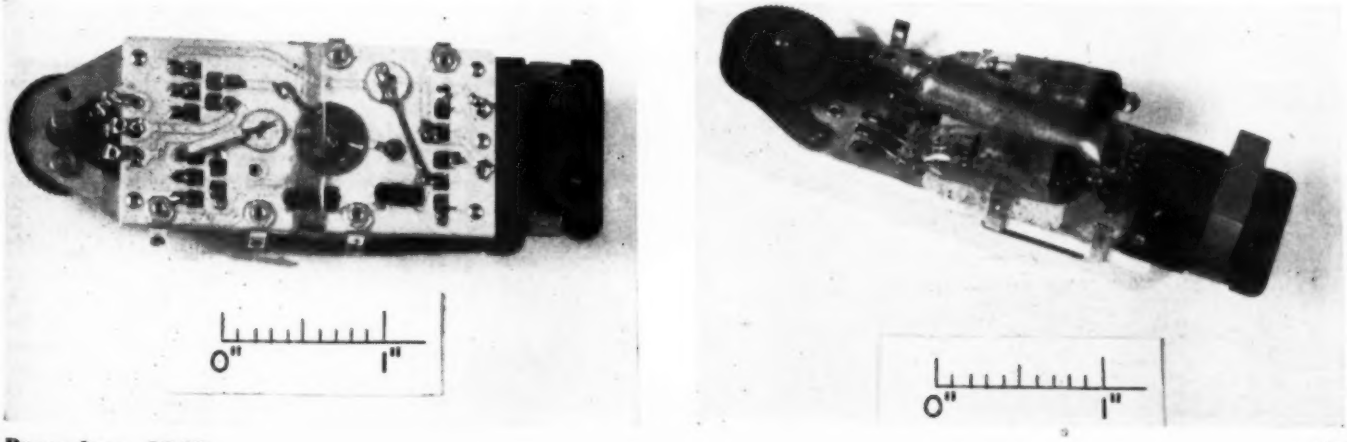


Fig. 6. A high temperature oven is used for firing a group of printed circuits.

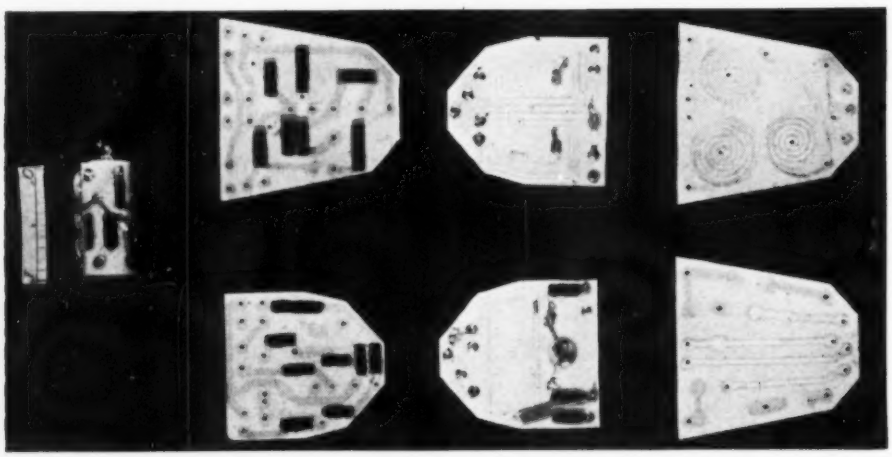
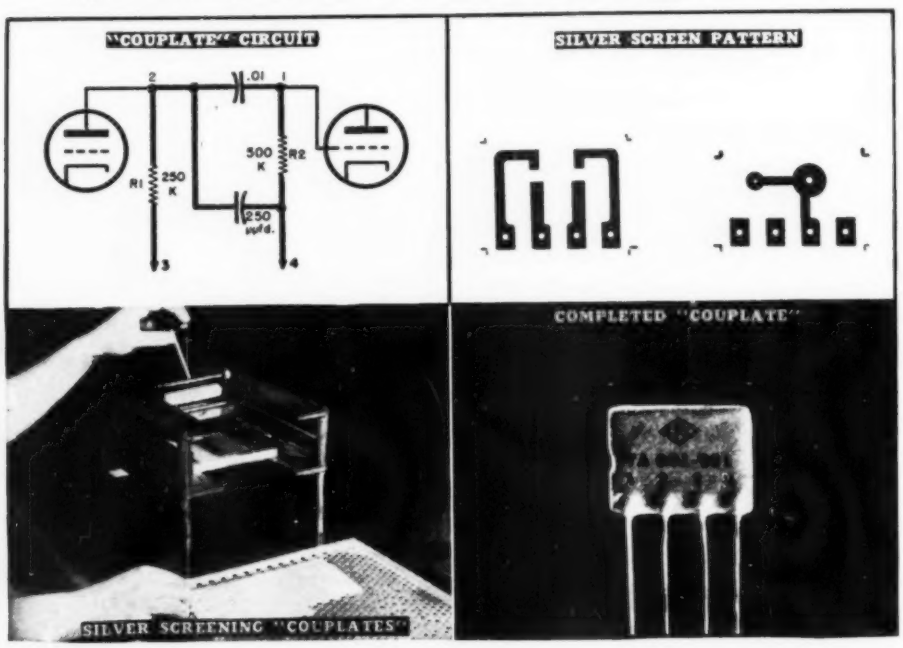


Fig. 7. Partially completed electronic circuits printed on steatite plates and cylinders by the silk-screen process. Light lines are silver conductors and inductors; dark rectangles are resistors; circular disks are ceramic condensers.

Fig. 8. Illustrating the evolution of an audio plate-to-grid coupling circuit.



screen are not the only ways in which the conducting and resistor paints are applied. For example, a decalcomania, on which the circuit is printed on a thin flexible film that can be transferred to the final surface, is useful in applying the circuits to cylindrical or irregularly-shaped objects. The film is removed by firing.

Most standard printing processes are also used. As a single example, the required design can be raised on the face of a rubber stamp, and this stamp can be pressed first on a pad of conducting ink and then on the surface to be printed. Plating of this printed design will increase its conductance if necessary. In the same way, other printing processes such as engraving, lithographing, and intaglio are also employed.

You old-timers who used to draw your own grid-leaks with a lead pencil were using a form of printed circuits that still may have possibilities. Pencils having "leads" of varying degrees of conductivity, or pens filled with conducting inks are being used experimentally. With such devices an experimental circuit could be drawn and constructed ready for testing all at one and the same operation!

Condensers can be painted, too, by employing silver disks painted on opposite sides of the base plate so that the plate material becomes the dielectric. If the plate is constructed of high-dielectric material, condensers of reasonable capacity can be obtained by this method; otherwise, miniature thin-disk ceramic condensers are often employed by soldering them with a low temperature solder directly to a silvered area on the base.

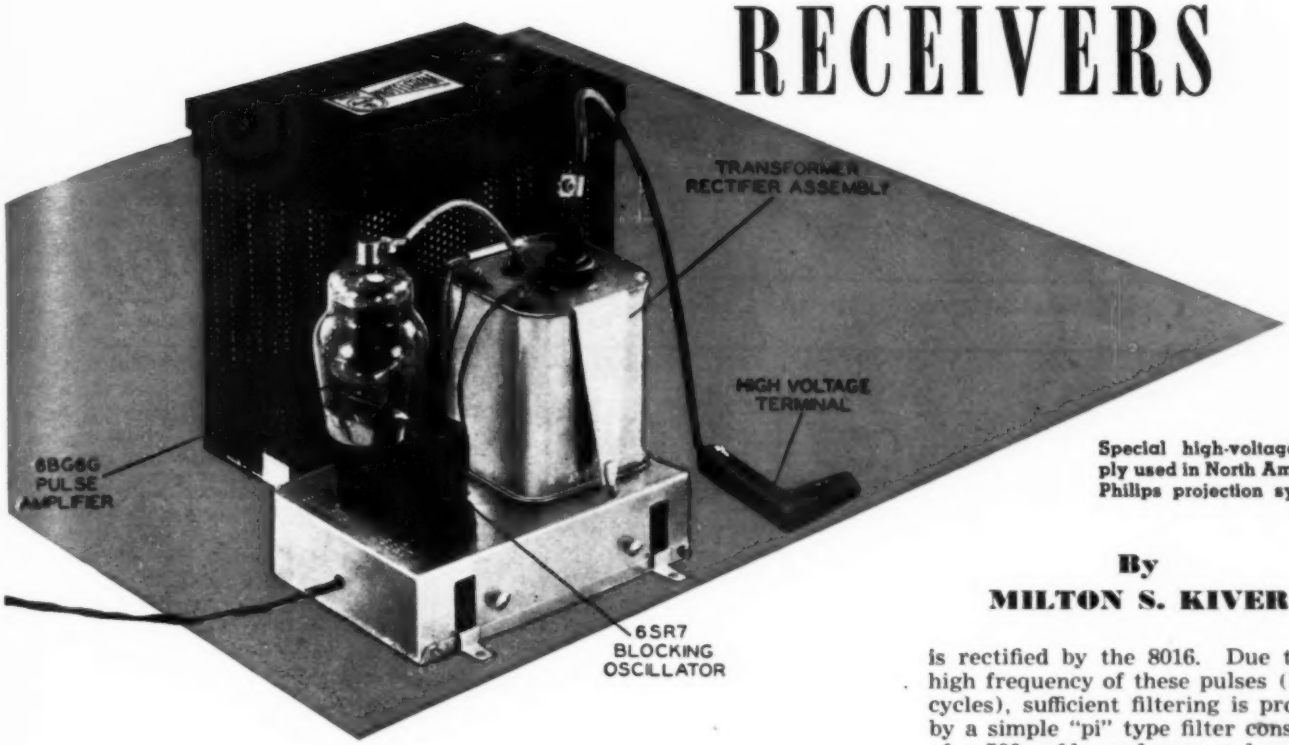
Printed inductors are also used, especially in the low-inductance values. Spiral forms are used on flat bases, although the more conventional forms can be used when the circuit is printed on the tube envelope or a cylindrical base plate as is shown in Fig. 9. The inductance of a spiral conductor can be increased by covering it with an insulating layer of lacquer and then painting another spiral right on top of it and connecting the two in series, painting another spiral on top of that, etc. The distributed capacity and the Q of the circuit required are the limiting factors to the usefulness of this method.

Placing a layer of magnetic paint, made of a colloidal suspension of powdered magnetic material, both beneath and above the spiral conductor, with insulating layers serving to protect the turns of the inductance from shorting, will also increase the inductance.

The spraying of conducting films on insulated surfaces is another method of printing circuits. The same paints can be used in paint spray guns as for the stencilled-screen process; or molten streams of metal can be sprayed through locating stencils. Guns are available in which the metal to be sprayed is fed into the gun in the form of a wire, where it is heated to the

(*Continued on page* 126)

MODERN TELEVISION RECEIVERS



Special high-voltage supply used in North American Philips projection systems.

Part 20. A description of flyback and pulse-type high-voltage power supplies that are part of the horizontal deflection systems of TV receivers.

By
MILTON S. KIVER

IN PART 19 of this series the structure of a horizontal electromagnetic system was analyzed, and it was there noted that when the plate current of the 6BG6 power tube driving the horizontal output transformer was suddenly cut off, a large amount of energy existed in the magnetic field present in the output transformer. Part of this energy was employed to return the electron beam from the right-hand side of the screen to the left-hand side, and the remainder was converted by the damper tube into additional d.c. voltage which is then added to the "B+" voltage of the low-voltage power supply and applied to the 6BG6 output tube.

The extremely short retrace interval of 7 microseconds which exists in the horizontal deflection circuit is used to further advantage in developing the 9000 to 11,000 volts required by the second anode of the picture tube. It is well-known that the voltage induced in any inductance is governed by the relationship

$$e\ (induced) = L\frac{di}{dt}$$

where di represents the change in current flowing through the coil (of inductance L) in the time dt. (There is a minus sign in the foregoing equation which has been disregarded because it possesses no significance here). In the horizontal output transformer, the plate current of the 6BG6, flowing through the primary winding, drops from a value of 77 milliamperes to zero in a period of less than 5 microseconds. With sufficient inductance in the primary winding, pulse peaks of 9000 to 11,000 volts may be developed during each retrace interval. These pulses have a repetition rate of 15,750 times a second and, by applying them to a diode rectifier, can be converted to d.c. and then fed to the cathode-ray tube. Since this voltage is developed during the retrace or flyback interval of a horizontal scanning period, the power supply is known as a "flyback" type of power supply. Occasionally the name, "inductive-kick" power supply is also heard.

A typical circuit of a flyback power supply is shown in Fig. 1. A special high-voltage rectifier tube, an 8016/1B3 tube, is connected across the full primary of the horizontal output transformer. During each horizontal retrace interval, a high positive pulse is developed across this winding and is rectified by the 8016. Due to the high frequency of these pulses (15,750 cycles), sufficient filtering is provided by a simple "pi" type filter consisting of a 500 $\mu\mu$fd. condenser, a 1-megohm resistor and approximately a 500 $\mu\mu$fd. condenser formed by the inner and outer aquadag coatings in the cathode-ray tube itself. This latter capacitance, incidentally, is just as real as any condenser bought from a parts jobber. It will store and retain electrical charge. Hence, before removing the picture tube from a set, be sure to discharge this capacitance by connecting a wire from the inside, high-voltage button on the side of the cathode-ray tube to the outer aquadag coating. Many a tube has been dropped when the technician failed to observe this precaution and accidentally touched the high-voltage button while carrying the tube.

Filament power for the 8016 is obtained from a small winding coupled to the primary of the horizontal output transformer. This tube was especially designed for this application, requiring only ¼ watt of power which can be taken from the circuit.

The foregoing represents the type of horizontal sweep circuits employed by nearly all television receivers having electromagnetic deflection tubes. With sets containing 15-, 16-, 20-inch and projection cathode-ray tubes, the 9 or 10,000 volts power obtainable from the foregoing circuit is not enough, and the high-voltage section of the receiver must be enlarged. A 15- or 16-inch tube requires a full 12,000 volts, and this can be obtained from the circuit shown in Fig. 2. The horizontal deflection circuit preceding the output transformer remains unaltered. However, the output trans-

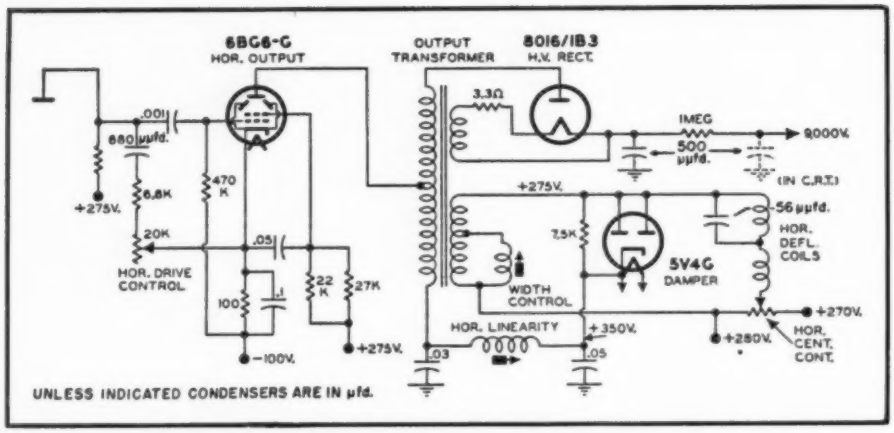


Fig. 1. Conventional circuit diagram of a flyback power supply.

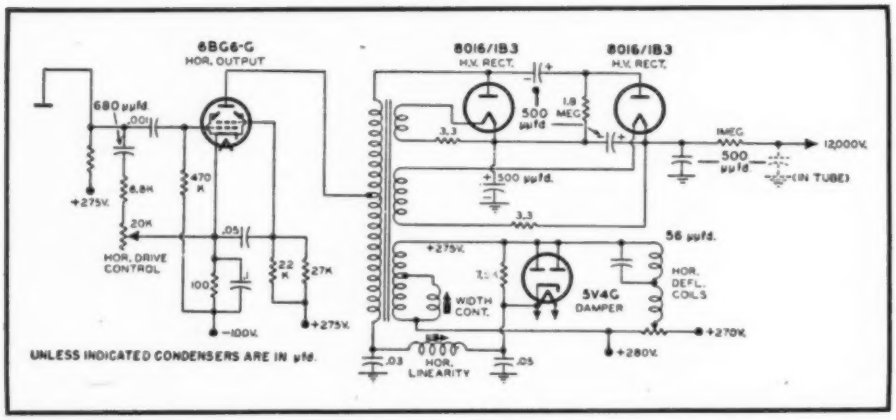


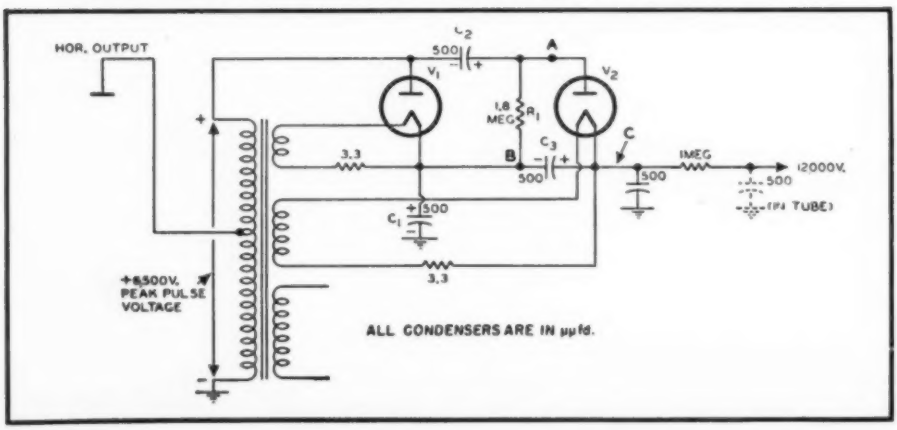
Fig. 2. A flyback high-voltage supply unit capable of producing 12,000 volts.

former is modified to produce a peak voltage of 6500 volts across the full primary and to incorporate two filament windings in the secondary. The additional filament winding is needed because two 8016 rectifiers are connected in series to develop the desired 12,000 volt output.

The operation of the rectifier circuit is best explained by using the equivalent diagram shown in Fig. 3. At the instant that the plate current of the 6BG6 flowing through the primary of the output transformer is cut off, 6500 volts are developed here. This voltage is applied to V_1, causing electrons to flow around through the primary winding and up to C_1, and forcing an equivalent number of electrons to flow out of the top plate and back to V_1. The electron flow continues until C_1 has charged to the peak value (6500 volts in this instance) of the applied pulse. Thereafter, V_1 remains non-conductive until the next positive peak, and even then nothing will occur unless some charge has leaked off of C_1, reducing the value of the voltage across the condenser.

During the interval when V_1 is not conducting, C_1 charges C_2 to its value because there exists a complete d.c. path between these two condensers. Electrons flow from the bottom plate of C_1, through the primary winding of the horizontal output transformer to C_2, and from C_2 down through R_1 back to C_1 again. Initially, the charging of

Fig. 3. An equivalent diagram of the high-voltage section shown in Fig. 2.



C_2 by C_1 reduces the voltage across C_1. However, after several seconds, C_1 and C_2 are both charged to essentially the full 6500 volts of the pulse.

We come now to the second rectifier, V_2, and its associated condenser, C_3. To understand how C_3 acquires its charge, consider the circuit when C_1 and C_2 are both fully charged, and the primary winding has a positive 6500 volts across it. If we add the voltages existing between points A and B at this instant, we note the following: C_3 has a positive 6500 volts which combine with the 6500 volts across the transformer for a total of 13,000 volts. Opposing this are the 6500 volts across C_1. Thus, V_2 receives an applied voltage of 6500 volts. Current flows through the tube, charging C_3 to 6500 volts with the polarity as indicated in Fig. 3. This places point C at a polarity of 13,000 volts, obtained from the combined voltages of C_1 and C_2. Actually, due to losses throughout the circuit, only a 12,000-volt output is obtained.

When the television receiver employs a projection tube, 25,000 to 27,000 volts are needed. To achieve this we use three 8016 rectifiers, instead of two, and employ a horizontal output transformer capable of developing 9000-volt pulses across the full primary winding. (See Fig. 4.) The operation of this circuit is similar to the preceding circuit with the addition that after C_3 acquires its charge, it then charges C_4. This brings us to the third diode, V_3, and if the voltages are added around the circuit, with the voltage across the transformer primary taken at its peak positive value, then it will be seen that V_3 has applied to it a voltage of 9000 volts, and it is to this value that C_3 charges. The addition of the voltages across C_1, C_3, and C_4 produces the desired output voltage of 27,000 volts. The 5TP4 projection tube utilizes electrostatic focusing, and this is supplied by connecting a bleeder network from the positive plate of C_1 to the low-voltage power supply. A 15-megohm potentiometer is then inserted at an appropriate point in this bleeder chain and the voltage applied to the proper base terminal of the image tube.

Examination of the full schematic of the horizontal output circuit, Fig. 4, reveals the use of a separate damper (6AS7) and a low-voltage booster (a 5V4G). In the circuit of Fig. 2, both of these functions were performed by a single tube (a 5V4G). However, better results can be obtained through the use of separate tubes, each designed for one specific application. The 6AS7 is concerned with damping out the oscillations and maintaining a linear beam motion, while the 5V4 converts some of the excess energy present during the retrace interval into d.c. voltage. In projection television receivers, where images 18"x24" or larger are obtained, horizontal linearity is quite important and requires special circuits, such as that shown in Fig. 4.

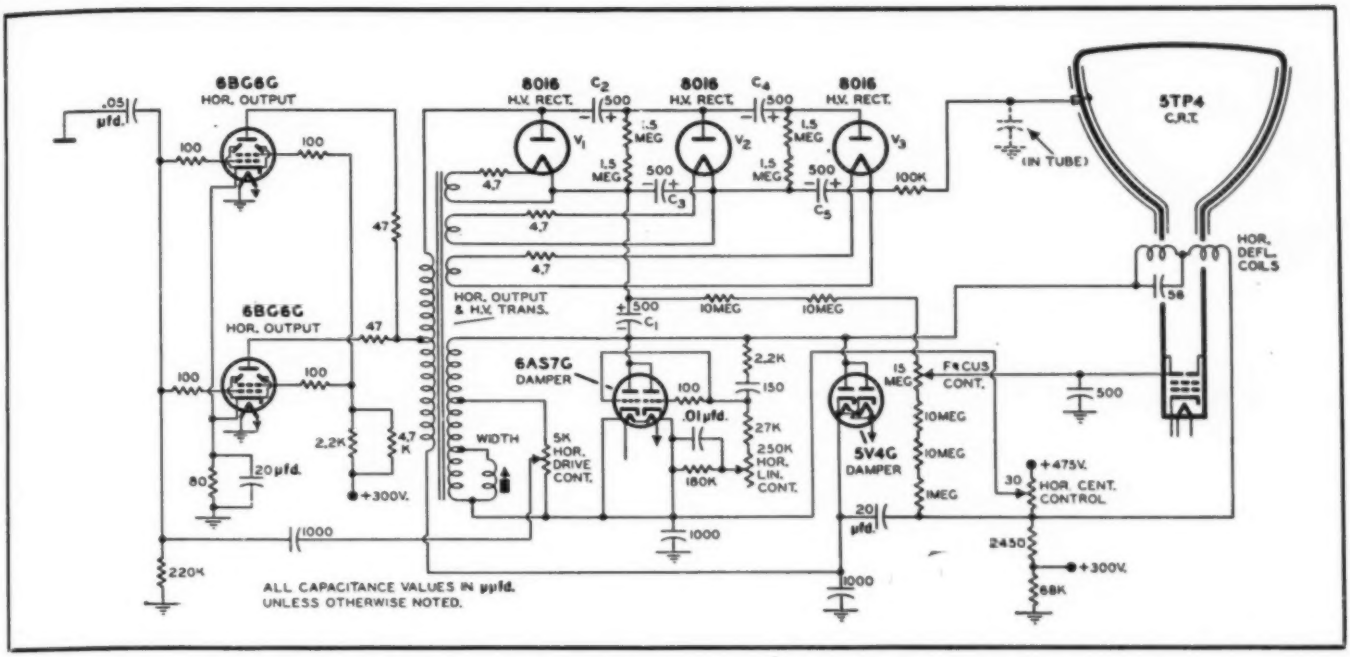


Fig. 4. An extension of the flyback circuit of Fig. 2 to provide 27,000 volts for projection tubes.

Beam Relaxer Circuit. A method for developing high voltage which is similar in some respects to the flyback method is employed in the circuit shown in Fig. 5. It consists of a horizontal output stage which is an oscillator driving the horizontal deflection coils directly and, during beam retrace, developing the necessary high voltages by the inductive flyback method.

The 6L6 horizontal output tube operates as an oscillator having its grid connected to the primary of the horizontal output transformer and its plate attached to a tap on the secondary winding. The screen grid receives negative horizontal sync pulses from the preceding sync clipper tube. These lock in the oscillator so that its frequency is kept in step with the incoming sync pulses.

To start the analysis of the circuit, assume that the tube has just been cut off, due either to the oscillator operation or the arrival of a negative sync pulse at the screen grid. (When the system is operating properly, the two actions will occur simultaneously.) With the stoppage of plate current, the magnetic flux of the transformer collapses, inducing a high negative potential on the grid of V_1 and a high positive potential on the plate. The voltage reversal brought about by the field collapse is also applied to the horizontal deflection coils, causing the beam to retrace rapidly.

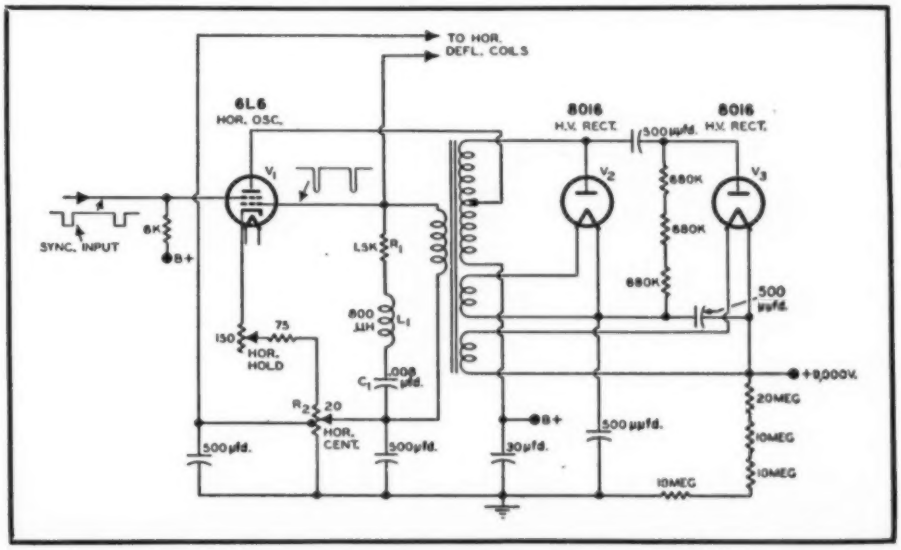
After the field has collapsed completely, the high negative potential on the grid of V_1 decreases, and the tube begins to conduct again, the rate of current flow being determined by the plate resistance of the tube and the inductance of the plate winding of the transformer. The plate resistance of the tube is controlled by the bias on the grid, and this, in turn, is a function of the resistance in the cathode circuit. Hence, by varying the cathode resistance, we can control the period of oscillation of V_1. The variable resistor is thus a "hold control."

The magnetic flux on the transformer starts building up now, and a positive potential is induced in the grid winding, thereby aiding the current growth throughout the circuit. Plate current flow increases due to the positive grid voltage until the tube reaches saturation. As current saturation is approached, the amount of positive induced grid voltage begins to decrease until a point is reached at which the voltage in the cathode circuit is sufficiently high to overcome the positive grid voltage and force the tube into cut-off. If the oscillator is properly synchronized, this will also be the moment for the arrival of a negative sync pulse to the screen-grid. We are now back to our starting point, completing one cycle of oscillation.

A 6L6 is used purposely for the oscillator because its plate current-plate voltage characteristics show a sharp "knee" or bend when plate current saturation is reached. This causes the tube to attain saturation sharply, cutting off the oscillator sharply and initiating a rapid retrace. A tube not of the beam power type would operate in this circuit, but since its characteristics do not possess this sharp "knee," the retrace time would not be as rapid and the induced voltage not so great.

Scanning voltages which drive the horizontal scanning coils are obtained from the primary winding of the output transformer. Also across this winding are connected R_1, L_1, and C_1 which affect the horizontal linearity and which are designed to damp out any shock-excited oscillations that

Fig. 5. Wiring diagram of a beam relaxation oscillator.



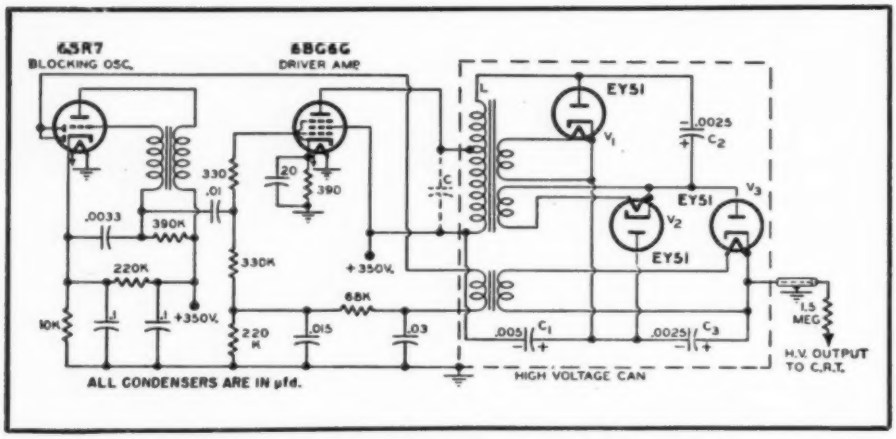


Fig. 6. North American Philips pulse-type high-voltage supply.

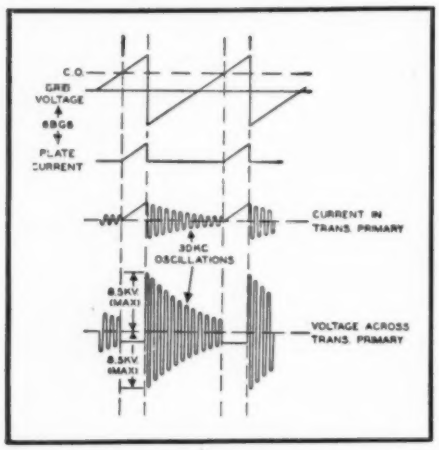


Fig. 7. Operating voltages and currents in the pulse-type unit shown in Fig. 6.

might develop in this winding. The potential developed across cathode resistor R_2 is a function of the average plate current and may be used for centering the image horizontally on the screen. One side of the deflection coil is connected to the movable arm of R_2, while the other end connects to a fixed tap. In this way we can change the relative voltage polarity between the two points from positive to negative and shift the beam to the right or left, as desired.

The incoming sync pulses may be obtained directly from the video signal itself, or from an automatic frequency control network of a type to be described later.

Two 8016 high-voltage rectifiers are series connected across the full secondary of the transformer, using the high surge of voltage during retrace to develop an output voltage of 9000 volts.

Pulse-Type H.V. Supplies. *North American Philips* has recently developed a special compact projection system which employs a special high-voltage power supply. This high-voltage supply is known as a pulse type and it differs from the flyback type previously discussed in that a separate pulse generator is employed, operating at a frequency which is considerably lower than the horizontal sweep frequency.

The circuit of the power supply, shown in Fig. 6, consists of a blocking oscillator, a driver amplifier, and a three-tube, cascaded, high-voltage rectifier. The blocking oscillator is conventional in form and operates at a frequency of about 1000 cycles. It produces a saw-tooth voltage which is applied to the grid of the following 6BG6 driver amplifier. (See Fig. 7.) The grid of this tube is biased beyond cut-off so that plate current flows only during the upper third portion of the saw-tooth wave. At the peak of the saw-tooth, the grid voltage of the 6BG6 drops sharply into cut-off, stopping the flow of plate current. Due to the inductance in the transformer windings and the stray capacitances across them, the system is shocked into oscillations. The values of these components were chosen to produce transient oscillations having a frequency of about 25 kc. The oscillations continue until the next flow of plate current from the 6BG6. This is indicated in Fig. 7. In the flyback system, a damping tube placed across the output transformer damped out all but the first cycle of oscillations. In this circuit no such damping is present, and the oscillations continue throughout the entire interval between plate current pulses. When the 6BG6 conducts again, it loads down the circuit, stopping the oscillations. The sudden stoppage of the plate current at the end of each plate current pulse then shock excites the transformer back into oscillations at its natural frequency of 25 kc.

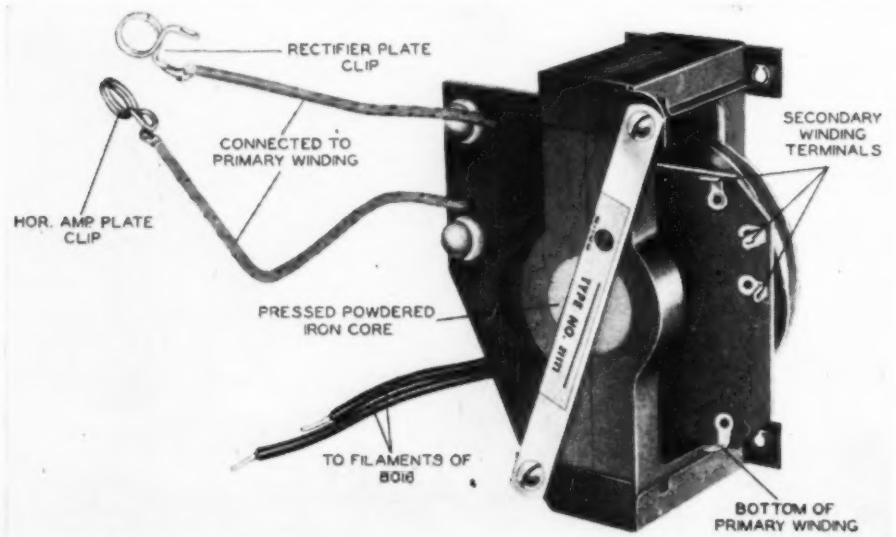
The voltage developed across the full primary winding of the output transformer is rectified by the three 8016 tubes to provide an output voltage of 25,000 volts. Since the high voltage is developed here a little differently than in the previous high voltage systems discussed, a brief explanation follows.

On the first positive oscillation peak (8500 volts), current flows through V_1 and C_1, charging the latter condenser to the full peak voltage with the polarity as shown. On the first negative peak, the voltage across the primary transformer winding adds to the voltage across C_1 to cause V_2 to conduct and charge C_2 to a peak value which is twice the transformer voltage, or 17,000 volts. Current, in this instance, flows from the cathode of V_2 to its plate, through C_1 and the transformer primary to C_2, and thence back to the cathode of V_2 again. On the next positive peak, C_3 is charged by current flowing through V_3, C_2, the transformer primary, and C_1 to C_3, and then back to the cathode of V_3 again, completing the circuit. The voltage across C_2 adds to the voltage across the transformer primary to feed a positive voltage to the plate of V_3. Opposing this voltage is the potential across C_1. The total positive voltage at this instant is 2v. (from C_1) plus v. (from the transformer) or 3v. Opposing this is v. from C_1. Hence, C_3 receives 2v. (3v.-v.) or 17,000 volts. By using the voltages across C_2 and C_3, we can obtain an output voltage of 25,500 volts. Actually, the output voltage is somewhat lower than this.

Note that in this system the oscillations in the transformer produce positive and negative high-voltage

(*Continued on page* 131)

The horizontal output transformer used in sets containing a flyback power supply.



Mac's RADIO SERVICE SHOP

By JOHN T. FRYE

BILL GETS THE FULL TREATMENT

"MONEY-MAD! Money-mad! The man is money-mad!" Bill the barber commented sadly as he peered through the open door of the service department at Mac and his assistant, Barney, working away at the bench.

"Money-mad my eye!" Mac detorted as he flipped off his soldering iron and kicked a stool across to his favorite fishing partner in a mute invitation to sit down. "In an *honest* business a man has to work six days a week to make a living. He cannot afford to take every Wednesday off and go around pestering other folks who don't have enough brass to ask eighty-five cents for ten minutes' worth of jockeying a pair of dull clippers around over a guy's noggin."

"That is a base calumny—especially that part about the dull clippers—but inasmuch as this is the season of convivial good fellowship, I shall ignore it," Bill said a trifle smugly as he perched himself on the high stool and cradled one knee comfortably in the sling of his interlaced fingers. "However," he continued, "I should think you would be glad to see a customer enter your spider-web."

"Did you say 'customer'?" Mac asked incredulously.

"Yes, I said 'customer,'" Bill mimicked with some asperity. "Money is not strictly a one-way proposition with me as it is with a certain Scotchman I know. This has been a fairly good year in the barber business—nothing colossal, mind you, in spite of your nasty innuendos, but a reasonably good year nevertheless. As a result, I thought I might sort of go all out for Christmas; and, in spite of the warning of my better judgment, I decided to drop around here first and see if you had any suggestions along the lines of making this an outstanding Christmas for the wife and the boy, Jim."

"Battle stations, Miss Perkins!" Mac called through a megaphone of his cupped hands to the office girl. "Prepare to execute Operation Customer. First, bring a round of Cokes from the refrigerator, and see that you get an especially large and cold one for our very good friend and customer here, Mr. Besop."

Barney, who was always more than ready to enter into any kind of horseplay, dashed into the furnace room and came back with an old shipping box filled with excelsior. "Here, Mr. Besop," he said as he knelt before the barber, "put your poor tired feet on this nice soft cushion."

Bill looked in mock apprehension at the boy obsequiously flicking imaginary dust from his shoes, at Mac standing in front of him rubbing his hands together in an unpleasantly suggestive manner, and finally at Miss Perkins who had appeared in the doorway, smiling as she extended a bottle of Coke toward him.

"Hey, what is this? Let me out of here! Quit looking at me that way!" he exclaimed, though reaching for the drink. "I feel just like a big fat worm that has fallen from a tree directly into a yard of hungry chickens."

Mac stepped back and squinted at the barber critically through a frame formed by his fingers. "There *is* a striking resemblance, now that you mention it," he agreed; "although there are some who might argue that the appearance is more that of the leech."

"Never mind them, Mr. Besop," Miss Perkins consoled. "I'll be glad to help you pick out something nice for your family, and I think I know the very thing for Martha."

She disappeared momentarily into the front of the store and came back bearing a tray on which rested an automatic electric toaster and a gleaming electric coffee-maker.

"I have often heard both you and Mr. McGregor say that you are likely to bite anyone who speaks to you before you have had breakfast," Miss Perkins explained; "but I suppose it never occurred to you men that taking a dim view of the start of a new day is not just a masculine trait. We women do not always awake just brimming with enthusiasm and good spirits either, but we still have to go ahead and set the machinery of everyday life to rolling again.

"Anything that tends to make the launching of a new day as effortless and painless as possible is all to the good, and this pair of breakfast-aiders will do just that. With them to do the work, Martha will feel almost like a guest at the breakfast table."

"Wrap them up and lay them away for me!" Bill ordered. "I never gave it a thought that Martha might be just as allergic to cold gray dawns as I am. If those doodads will help, she shall have them. But how about Jim? Got any ideas for him?"

"I think I have, Mr. Besop," Barney broke in excitedly. "You know what a hard time Mrs. Besop has in waking Jim up in the morning, especially if he has been out 'wolfing' until late the night before. Why don't you install one of our intercoms in your house with one substation right by his bed? Then, when Mrs. Besop wants to get him up, she can turn up the volume on the master station downstairs and practically blast him out of bed.

"What is more, I know from my own experience that it comes in mighty handy when a guy wants to call downstairs, 'Mom, where is my blue sport shirt? or, Mom, where are the clean towels?'

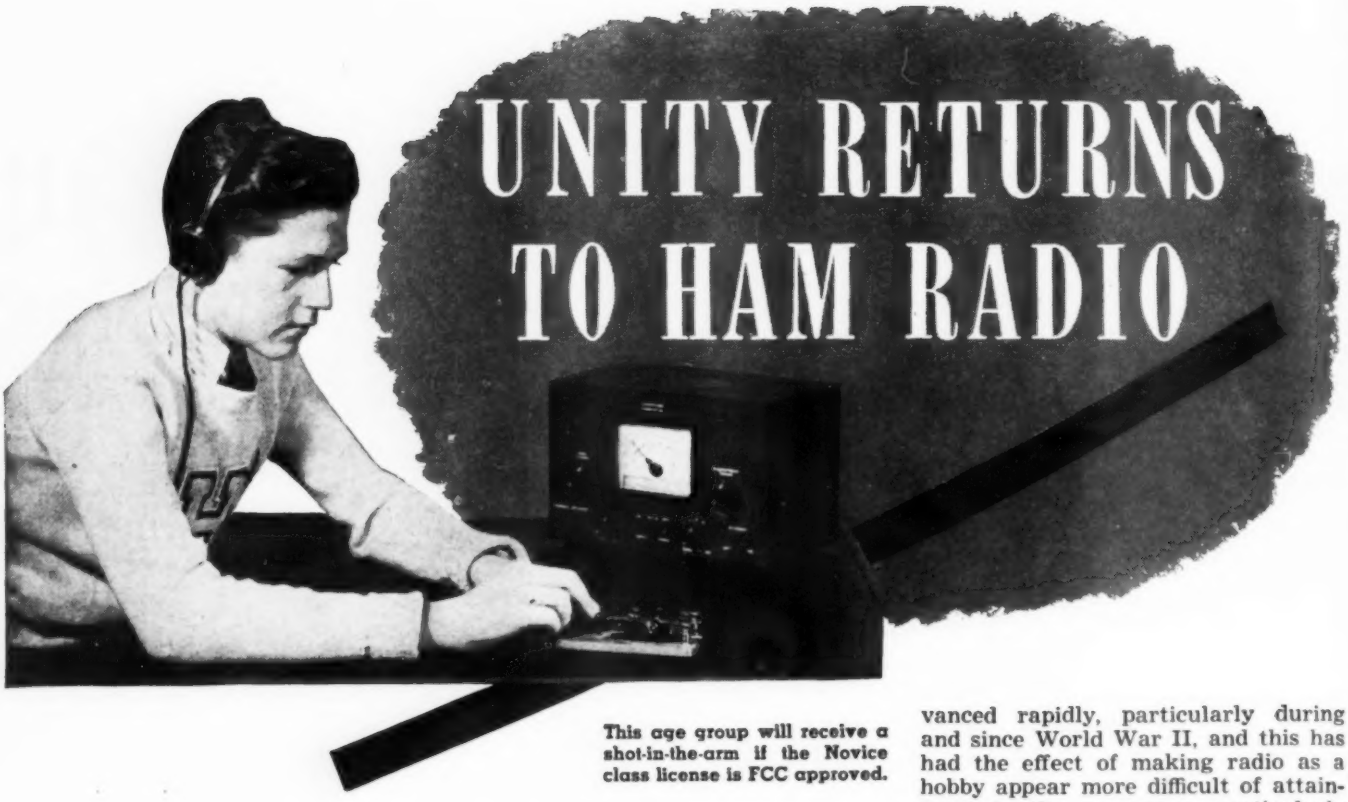
"And then you can place another substation in the basement game room and another out in your shop in the garage. That way Mrs. Besop can call either of you when she wants you, no matter how much noise you are making.

"Finally, I heard him say he *wished* he had one of our sensitive intercom outfits so that he and some of the gang could work out some ideas they have for a radio dramatic show. He figures that the game room could be used as a 'studio' while the 'audience' could listen in upstairs. That way they could try out sound effects and everything. And—"

"Stop! you human gramaphone!" Bill shouted. "You have won your commission already, so stop twisting my arm. I was hoping you might know what Jim wanted. But how about you, you old Scotch sourpuss," he said to Mac; "don't you have any

(*Continued on page* 108)

UNITY RETURNS TO HAM RADIO



This age group will receive a shot-in-the-arm if the Novice class license is FCC approved.

By RAY FRANK, W9JU
Associate Editor, RADIO & TELEVISION NEWS

Ham groups stand together to fight threats to hobby. Novice licenses get organizations' OK.

ONE of the greatest contributions to the future security of amateur radio was the informal conference held in Washington, D. C. on October 10-11, for a discussion of FCC proposals (Docket 9295). For the first time—hams of both majority and minority groups discussed their problems with ham representatives of the FCC.

This was not an "official" hearing. If it had been, there would have been a danger of disrupting amateur radio for a long time to come. As it turned out, and due to a last minute surprise move on the part of certain ARRL Directors, there followed a friendly discussion which resulted in UNANIMITY, something we have all been looking forward to for many a month.

From the very opening of the discussion, presided over by the very capable George MacClain of the FCC, until almost the last minute everyone was most congenial. They were friendly, and took an open minded viewpoint in their discussions. All conceded a lot, and came out with one great achievement, unity! Chairman MacClain introduced members of the FCC Amateur Division, G. K. Rollins, I. Brownstein, and R. W. Percy. Mr. MacClain pointed to the attempt on the part of foreign interests to "pick the hams apart."

First on the list of organizations who were to have the floor was the ARRL. Paul Segal, General Counsel, wanted individual reading of the League's report on Docket 9295. Mr. Segal was advised that the report must be read from the rostrum. From the appearance of the rather elaborate 32 page document prepared in advance by the League, it was obvious that as a result of "changes of heart" at the special board meeting, held on October 8th, there followed major changes as were indicated by brand new planographed revisions, particularly with respect to the Novice and Technician's Class of license. For example, in the original page 16 was seen the following, "it is the opinion of the League that while steady growth is necessary and desirable, any sudden great increase in amateurs, especially when attended by lower quality of amateurs as a result of lowered requirements, might present practical disadvantages outweighing any possible advantages. For these reasons, the proposed type of licenses *is not believed to be necessary.*"

The surprise came on page 18 of the planographed sheets which state in part as follows "in this proposal the League perceives an opportunity to foster additional interest among the nation's youth in the science of radio communication. It must be admitted that the state of the radio art has advanced rapidly, particularly during and since World War II, and this has had the effect of making radio as a hobby appear more difficult of attainment to the newcomer, particularly youth. If this class of license is established, the League believes it may well serve as a bridge or stepping stone to fuller participation in amateur radio after a year of "apprenticeship" training, and experience. Further, the League believes that civic organizations, local and national, may welcome such an opportunity to work radio training into their youth programs. The League is interested in giving every encouragement to the youth of America to become proficient in radio operation and techniques, and while not in favor of lowering the standards for amateurs, believes that the encouragement offered by the terms of the suggested Novice Class license will afford an opportunity for greater numbers of young people to enter the amateur and, subsequently, allied radio fields. For these reasons, the League regards the Novice Class of license, under suitable restrictions as to power and operating frequencies, *to be desirable.* The League requests however, that distinctive call signs be issued to the Novice Class licensees."

We suspect that George Bailey himself had much to do with this last minute change. We have known of his efforts on behalf of youth for many years (see "For the Record," page 8) and also credit is certainly due at least to a minority of the directors, including Jack Doyle, who saw eye-to-eye for the necessity of a Novice Class and Technician's Class license. It was quite apparent to those attending the discussion that the League, in the face of pressure from the minority interests, finally had a change of heart as indicated. As a result the League recommended the Novice Class and Technician's Class to the FCC.

Following the League's report, NARC, represented by Si Bing, Lew Gilmer, J. P. Vancheri, and John P. Southmayd (attorney for NARC) took over. The NARC gave full support to the League proposals to the FCC for revisions of the proposed rules. They stated that although these represented some differences from their own opinions, that in the interest of unity in Ham Radio, they would be glad to see the rules adopted as proposed by the League, and in this way heal the breach in the ham ranks.

Following NARC, Jack Boland and Ed Lynch of SARA took the stand and concurred in the feeling that the League's proposals were in the best interest of Ham Radio. Jack Boland stated that in the opinion of SARA, there was no danger of dictatorship from the FCC regulation of Ham Radio. This has been one of the main talking points of the ARRL against the proposal of the FCC. Boland stated that he, personally, was more worried over the future of Ham Radio due to the threats of other services and "internal friction within the ham ranks would serve to weaken the ham ranks and make them easy prey to other services who desire the use of these frequencies." He further stated that SARA will support any movement designed to help Ham Radio.

SARA has gone on record as favoring the Novice and Technician Class of license. Boland also felt that there should be some incentive for the advanced ham so that in the future the hams would be trained in the complex electronic equipment that is now being used by the Armed Services. The feeling that the average ham required additional training was also verified by military men who were present. Ed Lynch of SARA, felt that the controversial 12.0 portion of the rules, was needed so that Ham Radio would be furnished with a stated objective in order to justify its existence.

At the conclusion of the SARA discussion, there was an informal discussion on the subject of code speed for the Novice Class. The League felt that the contemplated 5 words-per-minute with the sending at a rate of 7.8 words-per-minute was entirely too slow and that much better training would be given if the speed of sending were increased to somewhere between 10 and 15 words-per-minute with the spacing between characters such that the average speed would be 5 words per minute. This was, in the opinion of the League, desirable in that it would enable the beginner to recognize characters more by their natural sound.

Red Rollins of the FCC said that in the Commission's experience they had found that the 7.8 word-per-minute rate would be satisfactory and that they had given over 300,000 operator examinations for commercial services and found that there were few failures due to the slow speed of sending.

We attended this informal meeting simply in the roll of reporters and individual hams and took no part in the discussions. It was felt that those who represented *organized* groups of amateurs should present their cases, and in this way, give the Commission staff a consensus of opinion. We felt that individual discussion of the various proposals in order to stress some particular "pet objective" would serve only to confuse the issue (and it did in one particular instance).

Following the remarks of SARA, Clyde Richelieu, W1JR, former Central Division Director, gave one of the most well-founded and enthusiastic talks on the results of the informal hearing. Clyde believed that the greatest thing that had happened was the acceptance by all parties concerned of the Novice Class.

George Bailey, before leaving the Monday meeting, congratulated both minority groups (NARC and SARA) on the marvelous spirit of cooperation shown and expressed his great personal delight in the results of the hearing.

Among those who also spoke briefly were Mr. J. McAulay, representing the National Council of States Executives of Agencies for the Blind. Mr. McAulay objected to the proposed 20 word-per-minute code speed requirements for the extra first class amateur radio license, although this license was not included in the final proposals as adopted by the various groups.

A group speaking for the Single-Sideband Operators was represented by Don Norgaard. Mr. Norgaard spoke at length on the proposals to increase the frequencies for phone in the 75 meter band and went on record as opposing the addition of any frequencies for phone use in this band. Mr. Norgaard also felt that no exclusive frequencies were needed for single-sideband phone operation and felt that the system itself was well capable of competing with the established forms of modulation under any conditions.

Albert Hayes, W2BYF, spoke briefly on the proposed frequencies for the Novice group. Mr. Hayes (speaking for himself—not representing any group) felt that the frequencies were ill chosen and some other portion of the 80 meter band would be better suited. At this point, one alert gentleman stood up and pointed out that Mr. Hayes operates most of the time on 3705 kc. (one of the frequencies in the band to be assigned to Novices). After discussion it was decided to adopt the Novice frequencies *as proposed by the League.*

Wm. Carley, representing several of the operators who consistently use the 50 mc. band, gave the results of an informal poll conducted by himself and other operators to determine the wishes of the 50 mc. operators as to frequency assignments. Of the approximately 450 active 50 mc. hams, 311 were polled and 201 returned the questionnaires. Of the questionnaires returned, 66% were in favor of assigning the frequencies from 50.0 to 50.1 mc. to c.w. use exclusively.

The meeting adjourned at approximately 5 p.m. and was rescheduled for the following morning.

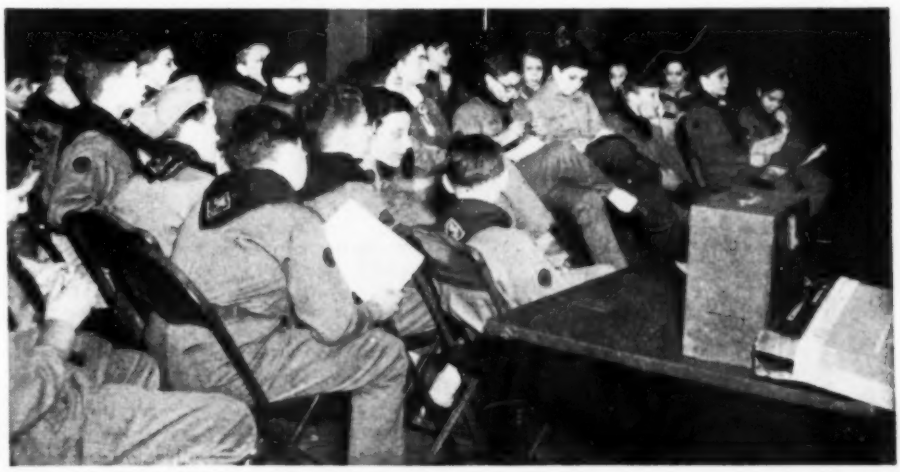
Mr. MacClain and the technical staff of the Amateur Division of the FCC literally burned the midnight oil to pour over the proposals and recommendations that were discussed throughout the day. These gentlemen, needless to say, are highly qualified not only because they are amateurs and therefore know the problems of a ham, but they are extremely capable engineers and know the limitations in the matter of assignment of frequencies, where and how they can best be used. They have the added ability to take a practical viewpoint on amateur techniques and limitations.

It is certainly to the credit of the FCC that the Commission appointed men of such caliber to study and recommend proposals that would serve the best interests of all concerned. Mr. MacClain himself won high praise and respect from the entire assembly for the effective manner in which the meeting was conducted.

The attendance on the following day was somewhat less and Mr. Brownstein, attorney for the FCC, brought up several questions which had arisen during discussion of the League's proposals by the FCC staff. These subjects were handled one by one, and all

(*Continued on page* 107)

Troop 510, Boy Scouts of America, studying ham radio under the direction of Charles Schram, W9UBT. This type of group would benefit most from Novice licenses.



Waveform Analysis in TV RECEIVERS

By JOHN B. LEDBETTER
Eng. WKRC-TV

The waveform comparison method gives positive proof of performance in any stage of the television receiver.

THE *absolute* operating condition of a television receiver can best be determined by making a detailed waveform analysis of each section and comparing it with the manufacturer's specifications. While this method is conclusive and may be very desirable in particular applications, it is far too laborious and time-consuming to be adopted as a standard method of troubleshooting by the busy service technician. When waveform analysis is used as a *relative* method of testing, however, it is one of the most efficient, thorough, and rapid systems yet employed.

In the *relative check* system, the receiver trouble is first isolated or narrowed to a particular section of the receiver in the usual aural or visual manner. A point-to-point waveform check is then made in that immediate stage and the resultant waveforms compared to a standard or recommended set of waveforms for that particular receiver. *Motorola, Philco,* and several other television receiver manufacturers illustrate the service manuals of a number of their sets with waveform photographs, along with peak-to-peak voltage readings. These photos are invaluable in determining the operating condition at any desired point in the receiver.

Service technicians employed by a radio distributor or retail store, or who otherwise have occasion to service a large number of receivers of the same make or model, will find it worthwhile to compile a list of waveform patterns and peak-to-peak voltage readings of each different model. Each successive receiver of the same or similar models can then be given a rapid reference check by comparing the shape and amplitude of waveforms in various stages against those of the compiled list. Voltage comparisons will give the relative loss or gain per stage of the receiver under test, while the waveshape comparison will reveal such faults as insufficient bandwidth, non-linearity, clipping, distortion, hum pickup, and a number of other occurrences which point directly to faulty components or incorrect adjustment.

A "standard" waveform record can be compiled by taking a receiver known to be in good operating condition and checking the waveforms and peak-to-peak voltages at various points in each stage (usually at the grid and plate). An outline of the waveform pattern can be quickly made by placing graph paper, or ordinary tracing paper, over the scope screen and tracing with a pen or pencil. Each tracing can then be placed in a notebook or miniature file system for future reference. The recommended procedure for making these tabulations will be discussed presently in more detail.

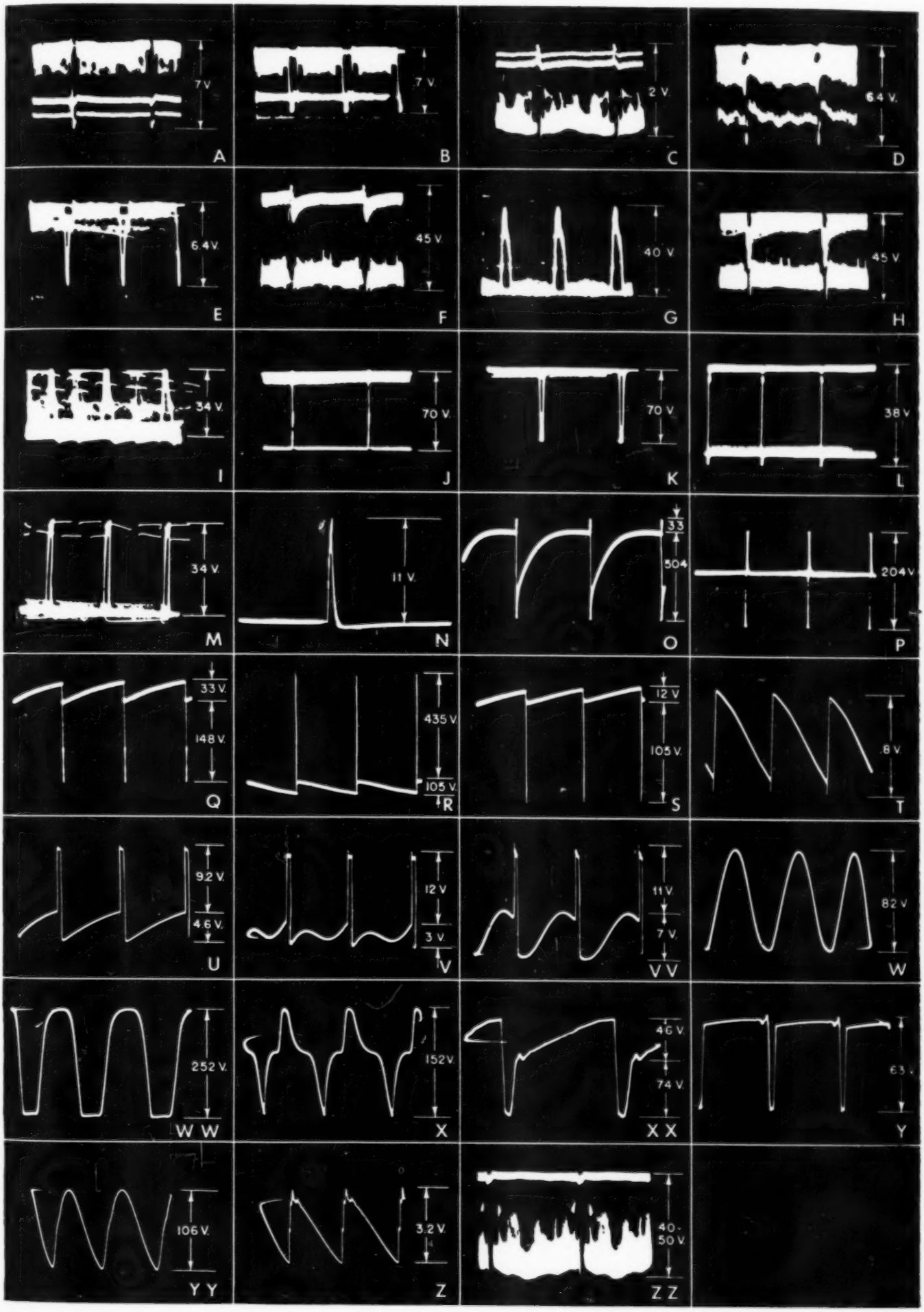
The average service technician who has been engaged in television receiver servicing and alignment for any length of time has already become familiar with the various response curves or waveform patterns of the oscillator, i.f., and discriminator stages. These have been adequately covered in past issues of this magazine and hence will not be repeated in this article. Emphasis instead will be placed on the sync and sweep circuits of the receiver and on the associated circuits, including the sync separator, pulse limiter, pulse stripper, etc. It is in these stages that a great many receiver difficulties are experienced.

Waveform Analysis and Tabulation

For checking waveform condition, the only equipment needed will be an oscilloscope, if provisions are included for calibrating the scope to read peak-to-peak voltages. In the *DuMont* Model 241 scope, for instance, a 1.6 volt, 60 cycle (peak-to-peak) voltage is available on the front panel for calibration. The 6.3 volt filament voltage of the receiver may also be used as a calibration source. To calibrate the scope, first obtain the desired waveform on the screen and adjust the vertical gain control until the pattern is large enough to read easily. Then apply the scope leads to the source of calibrating voltage and note the amplitude of deflection. In the case of the *DuMont* 241, the 1.6 v. peak-to-peak terminal would be used; in scopes not so equipped, the 6.3 v. (r.m.s.) filament winding of the receiver under test can be used. (It must remembered that the 1.6 v. calibrating voltage is set up as a *peak-to-peak* value for direct reading, while the 6.3 v. represents a r.m.s. value. To read an r.m.s. voltage as peak-to-peak, multiply by 2.8. Thus, the 6.3 v. filament winding would actually produce a peak-to-peak deflection on the scope of 17.6 volts.)

For screen calibration, either the graduated scale celluloid screen belonging to the scope, or a strip of linear graph paper fastened to the screen, may be used. With the vertical gain set as previously described, determine the units of deflection per volt. If an

Fig. 1. Waveform patterns as taken at various stages of a Motorola VK101 or VK101M television receiver. All following point references are made to the schematic diagram Fig. 2, page 58. (A) Detector output and 1st video grid, slow sweep. (B) Detector output and 1st video grid, fast sweep. (C) 2nd video grid, slow sweep. (D) Sync separator input, slow sweep. (E) Sync separator input, fast sweep. (F) Plate of pulse stabilizing amplifier, slow sweep. (G) Plate of pulse stabilizing amplifier, fast sweep. (H) Grid of pulse stripper, slow sweep. (I) Grid of pulse stripper, fast sweep. (J) Grid of pulse limiter, slow sweep. (K) Grid of pulse limiter, fast sweep. (L) Plate of pulse limiter, slow sweep. (M) Plate of pulse limiter, fast sweep. (N) Integrated vertical pulse measured at the junction of the 22,000 and 6800 ohm resistors between the pulse limiter 6J5 and the vertical blocking oscillator transformer with the 6SN7 vertical blocking oscillator tube removed, slow sweep. (O) Grid of the 6SN7 vertical blocking oscillator, slow sweep. (P) Plate of 6SN7 vertical blocking oscillator, slow sweep. (Q) Plate of 6SN7 vertical discharge tube, slow sweep. (R) Plate of 6V6 vertical output tube, slow sweep. (S) Secondary of vertical output transformer, slow sweep. (T) Vertical deflection coil current, slow sweep. (U) Center tap of horizontal sync discriminator transformer, fast sweep. (V) discriminator diode plate, pin #3 of 6H6 discriminator tube, fast sweep. (VV) discriminator diode plate, pin #5 of 6H6 discriminator tube, fast sweep. (W) Grid of 6V6 horizontal oscillator tube, fast sweep. (WW) Plate of 6V6 horizontal oscillator tube, fast sweep. (X) Grid of 6J5 horizontal discharge tube, fast sweep. (XX) Plate of 6J5 horizontal discharge tube, fast sweep. (Y) Secondary center tap of horizontal output transformer to ground, fast sweep. (YY) Bottom primary terminal of horizonal output transformer and ground, fast sweep. (Z) Bottom secondary terminal of the horizontal output transformer and ground, fast sweep. (ZZ) Saturated signal on the grid of the kinescope tube.


7 V.
A
7 V.
B
2 V.
C
64 V.
D
6.4 V.
E
45 V.
F
40 V.
G
45 V.
H
34 V.
I
70 V.
J
70 V.
K
38 V.
L
34 V.
M
11 V.
N
33
504
O
204 V.
P
33 V.
148 V.
Q
435 V.
105 V.
R
12 V.
105 V.
S
8 V.
T
9.2 V.
4.6 V.
U
12 V.
3 V.
V
11 V.
7 V.
VV
82 V.
W
252 V.
W W
152 V.
X
46 V.
74 V.
X X
63 V.
Y
106 V.
Y Y
3.2 V.
Z
40-50 V.
Z Z

odd number of units is obtained, increase or decrease the vertical gain of the scope until an *even* number of units can be counted. This will make direct reading of the deflection percentage much easier. Once the scope is calibrated, the amplitude of each waveform can be determined simply by connecting the scope leads to the desired test point.

Main requirement for the scope, in addition to its linearity and bandwidth, is that it should have a vertical sensitivity of 1 volt (peak-to-peak) or better. For waveforms taken at the vertical sweep and sync circuits, the scope must be synchronized at approximately 30 cycles to correspond with half the vertical sweep rate. For waveforms obtained from the horizontal sweep and sync circuits, it must be synchronized at 7875 cycles, or half the horizontal sweep rate. All tests should be made with the same signal applied at the receiver terminals. The standard RMA test pattern as broadcast from the television transmitter is recommended and should be used whenever it is available. The regular test pattern of the station may also be used, or the modulated output from a video signal generator, in the event no stations are on the air. It is, of course, understood that a variation in waveshapes in a number of stages will result if a reference signal other than that employed in the original tabulations is used in checking other receivers.

Typical Waveform Patterns

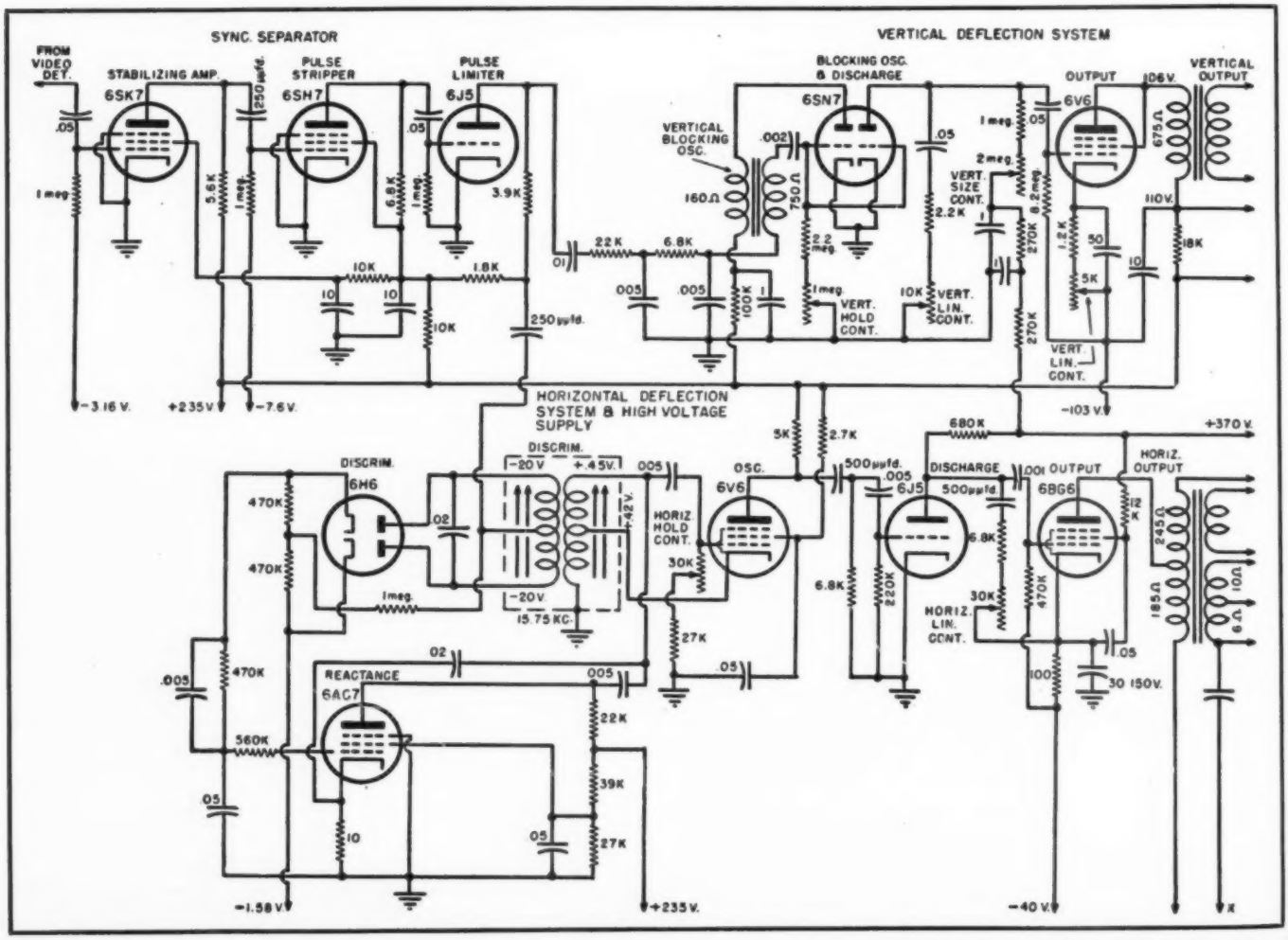
Waveforms shown in Fig. 1 were taken by *Motorola* engineers and apply specifically to *Motorola* Models VK101 and VK101M. Some alteration in these waveform patterns may be noted in receivers of different design, or even in receivers of the same model when a different scope is used. Waveform variation with individual scopes is generally due to the difference in capacity of the scope leads. Differences in scope linearity and frequency response can also account for part of this difference, especially in stages which pass video frequencies.

The waveforms as shown were taken on a *DuMont* Model 241 scope, using the low-capacity test probe. For the stages in which both horizontal and vertical pulses appear, two photos were taken, one with a slow scope sweep (30 cycles), and the other with a fast sweep (7875 cycles). For the slow sweep, the synchronizing selector of the scope is set for 60 cycles and the synchronizing control adjusted to obtain a stationary pattern. For the fast sweep, the synchronizing selector should be set for "Y" signal, or internal sync. With the frequency range control of the scope set to the slow sweep, the resulting waveform represents one or more complete *fields*. Waveforms taken with the range control on fast sweep will represent one or more *scanning lines*. In addition to the waveform patterns, the photos also show the amplitude of the various signals. These are based on a 0.7 volt signal at the grid of the first video stage.

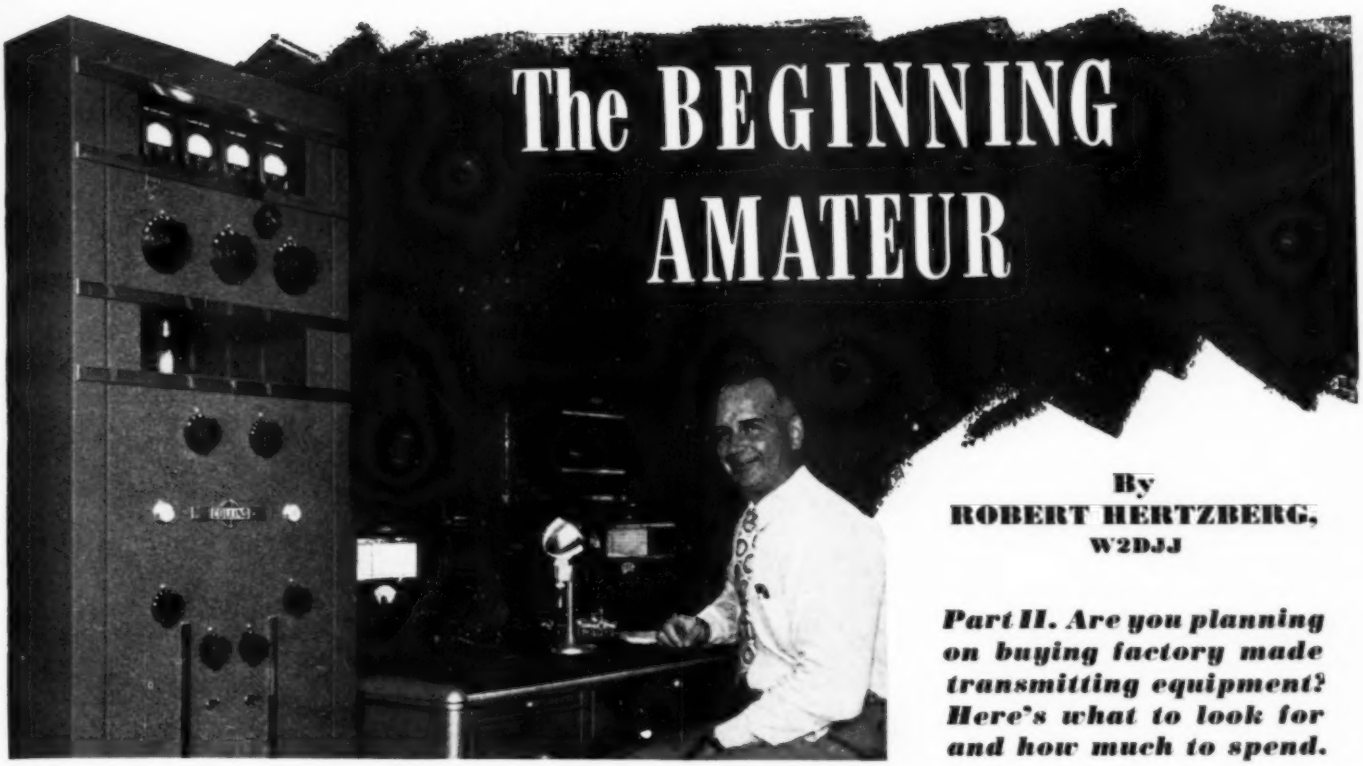
To obtain a waveform of the sawtooth current in the deflection coils, a 5 ohm resistor *must* be inserted in series with the deflection circuit, and the scope leads connected across the resistor. In the horizontal deflection circuit the resistor should be inserted in series with the plate supply lead to the 6BG6G horizontal output tube at a point below the coupling condenser (marked X in Fig. 2) when the *Motorola* VK101 is being checked. This is done to prevent an improper waveform which might result from the ripple voltage or damping diode action. In other receivers not employing a similar d.c. supply circuit, the 5 ohm resistor is inserted in series with the plate supply lead at the most convenient point. (Measurement across the 5 ohm resistor is necessary in the horizontal sweep circuit since the induced

(*Continued on page* 144)

Fig. 2. Partial schematic of the Motorola VK101 and the VK101M television receivers.



The BEGINNING AMATEUR



By
ROBERT HERTZBERG,
W2DJJ

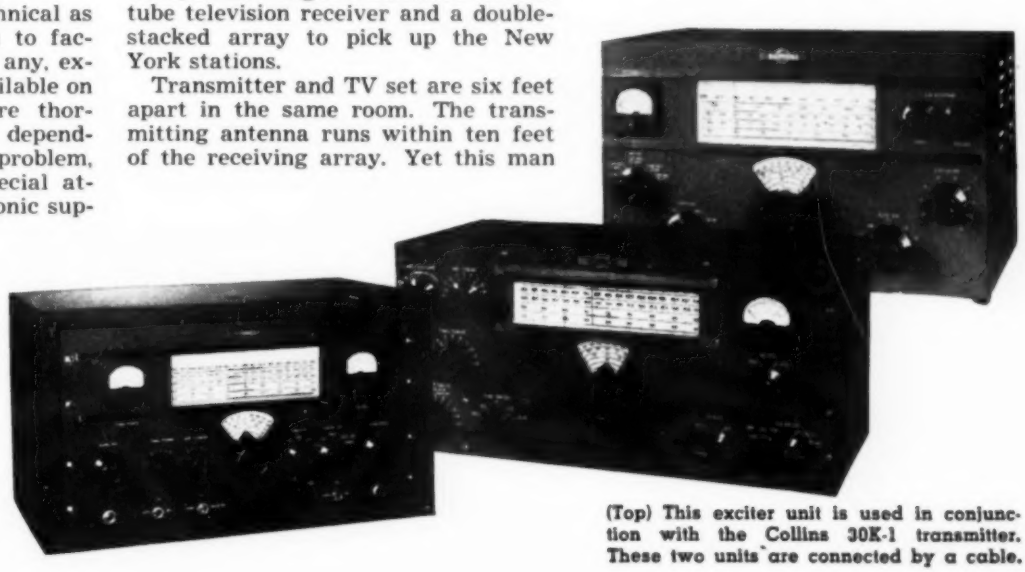
Part II. Are you planning on buying factory made transmitting equipment? Here's what to look for and how much to spend.

INSTEAD of "rolling their own," many amateurs buy factory-assembled transmitters. The usual reason is that they do not have the facilities or the time to do a proper job themselves. Some hams get more enjoyment out of operating than out of building and experimenting, and they don't mind spending a few extra dollars for equipment they know will work every time it is turned on. Also, commercial rigs as a general rule are much more compact in construction and more finished in appearance than homemade outfits. These are important considerations if the station is to be squeezed into a corner of a living room or incorporated into a well-appointed den. Many hams like to make an impression on visitors, and transmitters with engraved panels and chrome decoration undeniably do the trick.

There are certain sound technical as well as aesthetic advantages to factory-made units. With few, if any, exceptions, the transmitters available on the present ham market are thoroughly engineered and very dependable. Because of the TVI problem, manufacturers are giving special attention to stability and harmonic suppression and are working miracles. A recent demonstration in this connection proved the fact that TVI *can* be licked. A ham living in a very crowded veterans' housing project about 50 miles from New York City bought a new 150-watt phone transmitter and strung up an inconspicuous 132-foot, half-wave antenna for 75-meter phone, using No. 20 wire. This was draped in somewhat irregular fashion over several buildings and was supported in certain places only by tiny insulators removed from variable condenser frames. Other hams living in the project told him he was attempting the impossible, that any peep out of him after 5:00 p.m. would bring down the wrath of the community on his head, etc. This chap has three youngsters of his own who like to see Howdy Doody and Kukla, Fran, and Ollie, so he bought a sensitive 15-inch tube television receiver and a double-stacked array to pick up the New York stations.

Transmitter and TV set are six feet apart in the same room. The transmitting antenna runs within ten feet of the receiving array. Yet this man works 75-meter phone, with 150 watts, with the TV receiver cranked up to full gain, and there isn't the faintest sign of an interference pattern on the screen! As must be expected, he gets complaints of "interference" from neighbors even during those evenings when the station is off the air, or when he and his wife are at the movies.

From the standpoint of application, commercial transmitting equipment can be broken into two categories: exciters and complete transmitters. An "exciter" is simply a small, low-power oscillator, very accurately calibrated in frequency and provided with a well-regulated power supply so that the generated radio-frequency signals are very stable. Bandswitching is usually included, the bands up to about 30 megacycles being covered. The



(Center) This Collins transmitter is similar to the exciter unit shown at the right with an antenna network added.

(Left) The Collins 32V-2 is an extremely compact phone-c.w. transmitter of 150 watts c.w. input, and 120 watts on phone.

(Top) This exciter unit is used in conjunction with the Collins 30K-1 transmitter. These two units are connected by a cable.

Millen 500 watt final amplifier. Designed for push-pull 812 tubes, it may be readily changed to other tube types of similar rating.

Millen bandswitching v.f.o., featuring full bandspread on all bands from 80 to 10 meters.

A 50 watt transmitter-exciter unit by Millen. Requires an external power supply and features plug-in coils.

Millen 90811 high-frequency amplifier unit. This is intended to go into a complete transmitter.

power output is in the neighborhood of a few watts.

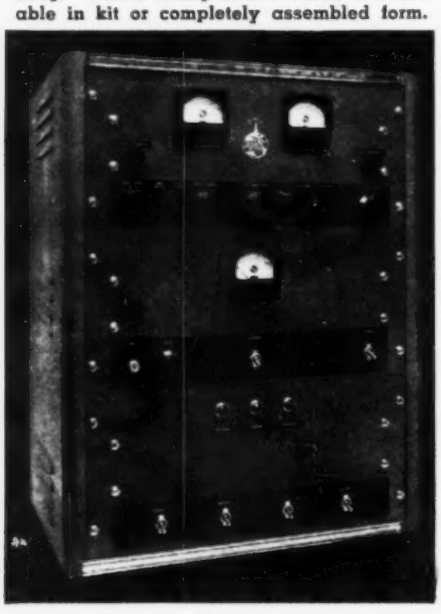
The exciter is invariably kept on or next to the receiver in the operating position of the station and its output is fed into a buffer-power amplifier-modulator unit which can be across the room. An advantage of this arrangement is that the operator can shift his position within a band, as interference dictates, by making slight adjustments on the exciter alone. He usually doesn't have to retune the power amplifier because the circuits in it are a trifle broad. The permissible range of adjustment without amplifier trimming varies with different transmitters and is enough to make operation very flexible. One of the most popular exciters of this type is called a "Signal Shifter" because the name describes its function exactly. Exciters in general are often referred to as "v.f.o.'s," meaning "variable frequency oscillators."

Many hams invest in a good v.f.o. and then build up their own amplifier-modulator stages. This is a sensible and economical idea, as it combines the advantages of factory-made quality and the fun of experimenting.

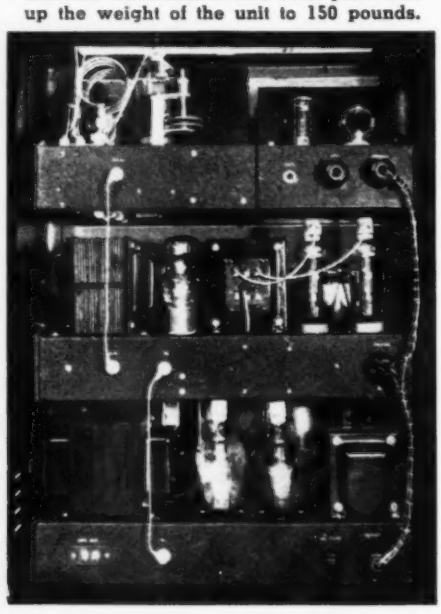
An exciter by itself is a complete little c.w. transmitter. Some exciters contain provisions for narrow-band FM, and are therefore complete phone as well as c.w. transmitters. With a proper antenna and transmission line, a v.f.o. is capable of extraordinary DX all by itself. As experienced hams well know, power is much less important than a clean, stable signal under the control of a patient, careful operator. Many amateurs who start with an exciter, with the expectation of supplementing it later with a husky amplifier, stop right there when they discover that low power gets out. One standard v.f.o. has an output on c.w. of about 15 watts, and that's a respectable rating in any league.

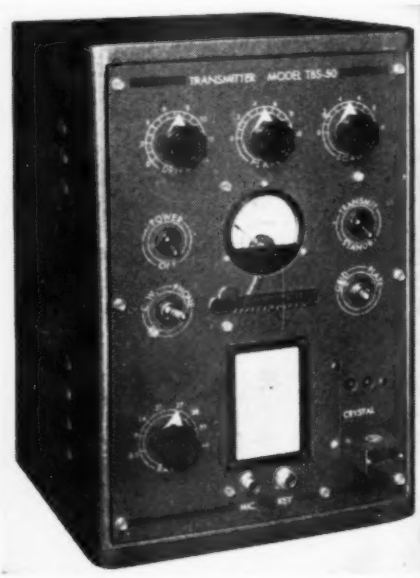
With transmitters, as with receivers, you get what you pay for. The expensive elements of a transmitter are in the power supply rather than in the r.f. section; power and modulation transformers, filter chokes and filter condensers start to cost real money when you get into high power. There's no economy in "cheap" parts. If, for instance, a 1000 volt rated filter condenser is used on 1000 volts, and a sudden line surge hikes up the voltage a bit and kicks out the condenser, the rectifier tubes and the power transformer are likely to go up in smoke. Unexpected things happen at high voltages, as every ham finds out at some stage of his career. That's why it is wise to check over the specifications and ratings of all parts of a transmitter before buying.

This World Radio Labs. transmitter, "Globe King," with a rating of 275 watts, is available in kit or completely assembled form.

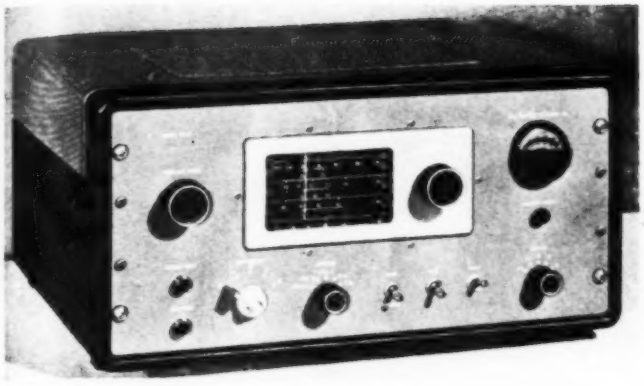


Rear view of the "Globe King" transmitter. Chassis, transformers, and other parts add up the weight of the unit to 150 pounds.





A 50 watt bandswitching transmitter for both phone and c.w., made by Harvey-Wells. Covers all ham bands from 2 to 80 meters.



The Hallicrafters HT-19 transmitter is modern in design.

Hallicrafters HT-18 v.f.o.-exciter unit. It contains NBFM.

Although amateur stations are permitted, under FCC regulations, an input to the final stage of 1000 watts, comparatively few hams use that much power, and the biggest factory-made transmitter sold today (for strictly amateur purposes) is rated at 500 watts. The restricting factors are both electrical and mechanical. A "500-watt" transmitter draws about three times that much power from the line, and that's about as much as an ordinary house circuit can furnish without burning up. A one-kilowatt rig requires a special power line. Also, the copper and steel in big transmitters makes them difficult to pack, ship and install. The *Collins* 30K-1, rated at 500 watts, weighs something like 600 pounds. You can't push that around by yourself! The floors of many homes won't even support that much weight concentrated in one spot.

Transmitters in the 100/200-watt bracket represent the best compromise of the conflicting factors of cost, power, and interference-producing potentialities. Besides, they are compact, table-top jobs and you can move them around, when necessary, without straining yourself or requiring the services of a rigging team. Remember that power alone is no guarantee of anything except big utility bills and *QRM* headaches. It's the amount of r.f. energy you get into the antenna that counts, not the mere volts-times-amperes combination in the plate circuit of the final amplifier tube.

For your guidance in comparing and selecting apparatus within the range of your pocketbook, there follows herewith a condensed listing of the recognized exciters and transmitters now being offered for ham use. Because this equipment represents a considerable investment, you should write to the manufacturers for detailed data on any particular item that appeals to you, and you should satisfy yourself in advance, before you buy, that it will meet your requirements.

Exciters.

Bud Model VFO-21: Uses 6F6 oscillator, 6V6 amplifier, VR-105 voltage regulator, NE-51 tuning indicator, and 5Y3 rectifier; output about 4½ watts; uses four sets of plug-in coils to cover 10-, 20-, 40- and 80-meter bands; with one set of coils, $52.

Meissner "Signal Shifter": Uses 6V6 oscillator, 807 amplifier, 6U5 tuning indicator, OA3 and OD3 voltage regulators, and two 5Y3 rectifiers; six-position bandswitching coil turret, 10 to 80 meters; output 6 watts; in kit form, $50; factory-assembled, $100.

Millen 90711 V.F.O.: Uses 6SK7 oscillator, 6SK7 buffer, 6AG7 amplifier, 5Y3 rectifier, and VR-150 voltage regulator; temperature compensated circuit; bandswitching, covers 10 to 160 meters; bandspread tuning; $90.

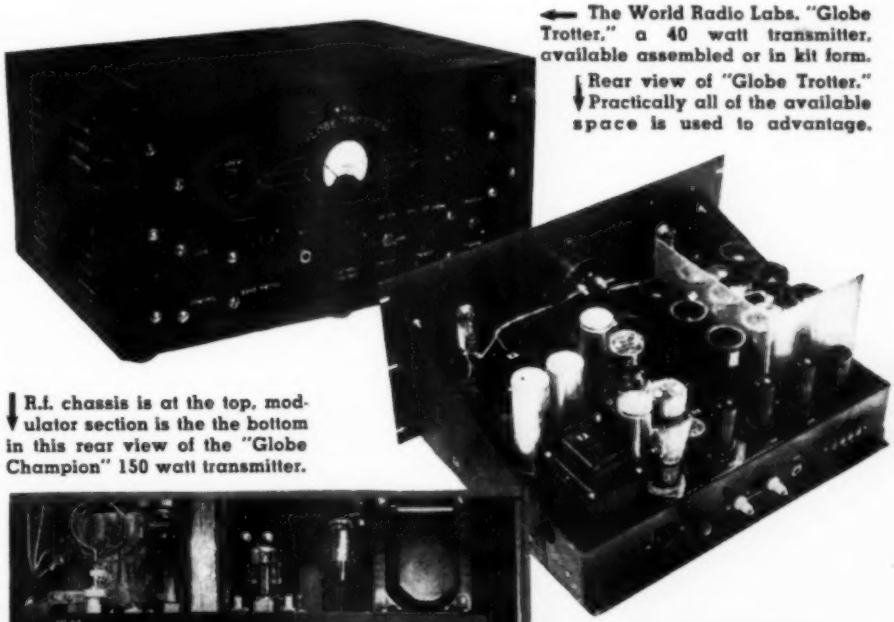
Hallicrafters HT-18: Uses 6BA6 oscillator, 6BA6 speech amplifier, 6BA6 modulator, 6L6 amplifier, 5Y3 rectifier, and VR-105 and VR-150 voltage regulators; bandswitching, 10 to 80 meters; operating with NBFM included, with built-in mike amplifier; provision for three crystals; output about 3 watts; $110.

Collins 310B-1: Uses 6SJ7 oscillator, three 6AG7 multipliers, 2E26 amplifier, 6SL7 sidetone oscillator, 5R4GY high-voltage rectifier, 5Z4 low-voltage rectifier, 6H6 bias rectifier, and VR-105 and VR-150 voltage regulators; output about 15 watts; band-

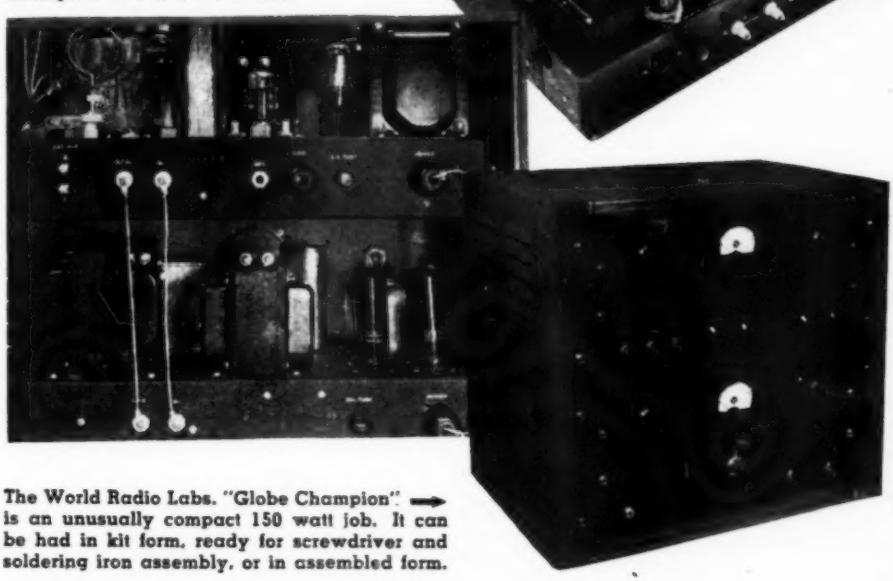
(*Continued on page* 114)

← The World Radio Labs. "Globe Trotter," a 40 watt transmitter, available assembled or in kit form.

↓ Rear view of "Globe Trotter." Practically all of the available space is used to advantage.



↓ R.f. chassis is at the top, modulator section is the the bottom in this rear view of the "Globe Champion" 150 watt transmitter.



The World Radio Labs. "Globe Champion" → is an unusually compact 150 watt job. It can be had in kit form, ready for screwdriver and soldering iron assembly, or in assembled form.

Recording Stationary CRT PATTERNS

Fig. 1. Special bracket is used to mount home-built camera to the oscilloscope.

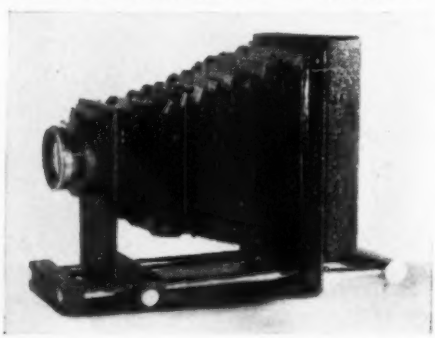
This camera, home-built at relatively low cost, is ideal for photographing those CRT patterns.

By
LEONARD HESSE

A CATHODE-RAY oscilloscope often must be used when adjusting or designing certain circuits. When working on the solution to a specific problem, it is sometimes necessary to view a large number of traces. Since the mental comparison of results may lead to confusion, a logical procedure to follow is to photograph each interesting trace and then compare the photographs as a group.

When considering that writing speeds of about forty inches per microsecond can be obtained with special equipment, it is logical to assume that stationary patterns can be photographed satisfactorily with almost any camera. This assumption is correct if certain features are available in the camera used, or if certain modifications can be incorporated to produce the desired results.

Fig. 2. Over-all view of home-built camera. Although in appearance this camera does not compare with commercially available units, its performance is exceptional.



To illustrate the results which can be expected, a certain double-ended square wave was photographed with a number of cameras. The height of the trace was adjusted to exactly one inch. A 3GP5 tube was used with a light shield, and screen brightness was normal.

Using Super XX panchromatic film in a cheap, fixed focus folding camera having a normal lens speed of *f*11, and equipped with a "plus 3" portrait lens, a negative was obtained from which the contact print shown in Fig. 3A was made. About one second exposure time was allowed. A "plus 3" portrait lens has a strength of three diopters, and, when in focus, the distance from this auxiliary lens to the tube face was 12⅜ inches. While the resulting picture is a good reproduction of the trace, it is rather small. Though it could be enlarged, the requirements of a satisfactory technique rule out an enlargement process.

Any camera can be made to produce an image approximately full-size by doing either of two things. The first, and probably the easier, is to use a powerful auxiliary lens, the function of which is to shorten the focal length of the normal lens and permit a much larger image of a small object at close range. Fig. 3B is again a contact print made from another negative of the same film which produced Fig. 3A. An auxiliary lens with a strength of ten diopters was used to produce the image shown, and the distance from the lens to the tube face was reduced to 4⅛ inches. Fig. 3B also illustrates a slight amount of distortion which may be introduced at the ends of the trace by using a powerful auxiliary lens. When using this camera, eight 2¼x3¼ inch negatives are obtained from one roll of No. 120 film at a cost of about six cents each.

A second method of producing a larger image than can be obtained with a normal lens is to increase the distance between the lens and the film. Practically the only camera which will permit a sufficient increase in this lens-to-film distance is a view type with at least a double bellows extension. Examination of Fig. 3C reveals that excellent results can be obtained with a camera of this type. Fig. 3C is also a contact print of the same wave shown in Figs. 3A and 3B and was taken with a *Goerz* 9x12 cm. view camera with double bellows extention and a *Dogmar f*4.5 lens. The adequate bellows extension eliminated the necessity of using an auxiliary lens, and the distance from the lens to the tube face was 11 inches. Using such a view camera results in a setup which is very convenient and which produces an approximately full-sized, distortionless image at maximum lens openings. Unfortunately, however, such a camera is not readily available to most scope users.

A vest-pocket size camera fitted with a ten diopter auxiliary lens produced the 1⅝x2½ inch negative from which the contact print shown in Fig. 3D was made. Examination of Fig. 3D reveals that some distortion and non-uniform image density is present. This is the

result of not having the lens and tube centerlines exactly in line. These "in line" conditions must be adhered to when using small cameras with short focal length normal lenses in conjunction with auxiliary lenses to produce images of usable size by working close to the tube face. One limitation presented by a small camera is that the size of the image is limited by that of the film.

One objection to using a roll film type of camera for this work should be obvious. Very often the desired negative is sure to be in the middle of the film strip. In order to develop the desired record, it is necessary to waste the remaining portion of unexposed film, or wait until the balance of the roll has been exposed. Cut film holders such as are used with view types of cameras, on the other hand, make each record readily available for instant processing.

Panchromatic film should be used to photograph a green trace, and a one-second exposure will produce a satisfactory record. If a tube is available which produces a blue trace, such as was used by the writer to record the traces shown, the problem becomes very much simpler. A blue trace permits stationary patterns to be photographed directly on recording paper with a low value of screen brightness, still permitting short exposure times.

Fig. 3E shows this same wave as photographed on No. 697 *Kodak* recording paper. This paper is obtainable in rolls, and can be cut to fit a cut film holder. The resulting records are obtained at a cost of about two cents each. The use of recording paper offers certain advantages, since it can be handled with care under a No. 2 safelight. It is developed like any sensitized paper, but one disadvantage is that the resulting image is reversed. If it is desired, however, the paper can be used as a negative and a positive print made from it.

Comparing the photographs which have been presented and considering the advantages and limitations of the photographic equipment discussed, it is possible to list the following requirements which equipment should possess for the recording of stationary patterns:

(1) The recording material (film or paper) should be used in a cut film holder to permit immediate processing.

(2) Equipment cost should be low enough to make the venture attractive.

(3) A means should be included for supporting the camera to reduce to a minimum the set-up and take-down times.

(4) No adjustments should be necessary prior to making a recording.

(5) Compactness should be a "must."

(6) Record should be approximately full size.

No low-cost equipment could be found which would satisfy all of the desired requirements. Because simplicity was desired and also since a camera can be a simple thing consisting of a lens and shutter on one end, a provision for holding film on the other end, and a light-tight member between the two ends, it was decided to build one incorporating all of these desirable features. The result, shown in Fig. 2, was completed at a cost of less than $11.50.

No attempt was made to reduce weight, and the design could have been simplified. The frame and lensboard are of ⅛ inch sheet brass; the rails are of ⅜ inch brass rods which have been hard-chrome plated. Steel bar stock was used for the rail supports and slider. These three pieces were clamped in a drill press vise and drilled together so that the holes would be in line. The holes in the slider were then reamed slightly oversize to slide freely. Bookbinders' leatherette was used for the bellows. Several coats of automobile top dressing should be applied to the bellows after assembly to the ¼ inch thick marine plywood end frames. Sheet brass, 1/32 thick, was used for the back into which the cut film holder slips. The 4x5 inch cut film holder is held against hardwood strips by phosphor bronze springs. Black mohair cloth was glued to the inside edges and front of the back to provide an effective light seal. A handle of aluminum rods provides the means for convenient manipulating. Two ¼ inch diameter holes in the bottom of the frame are drilled to receive two aligning pins projecting from the supporting bracket.

Since these provisions accurately orient and align the camera, the only set-up time needed is that necessary to fasten the camera to the bracket by means of the cup and knurled screw. It would not be necessary to provide the amount of bellows extension shown, or even to make an actual bellows. Any sort of a light-tight member would be satisfactory if traces only are to be photographed. This gadget results in a fair view camera for other photographic work, however, and the addition of a housing containing a light

(*Continued on page* 161)

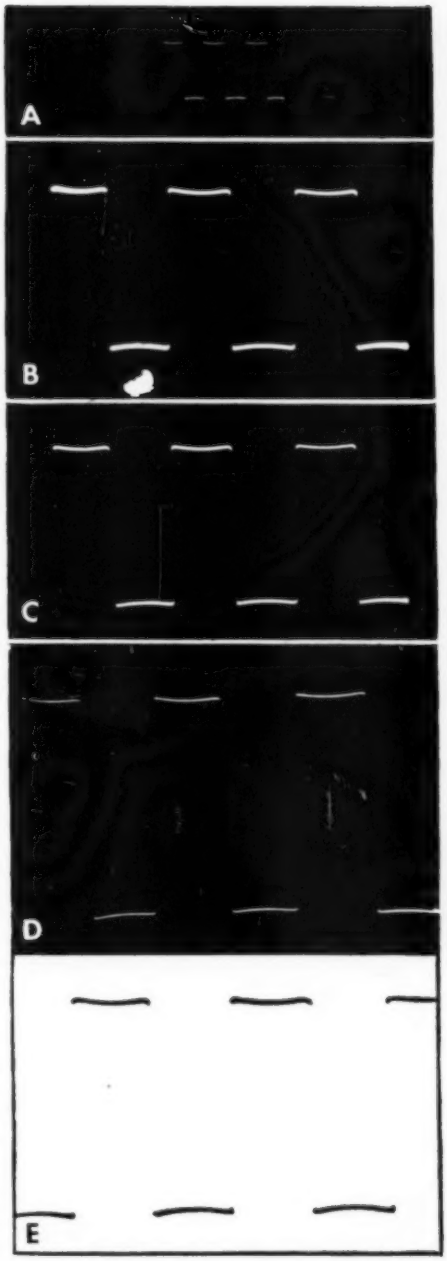
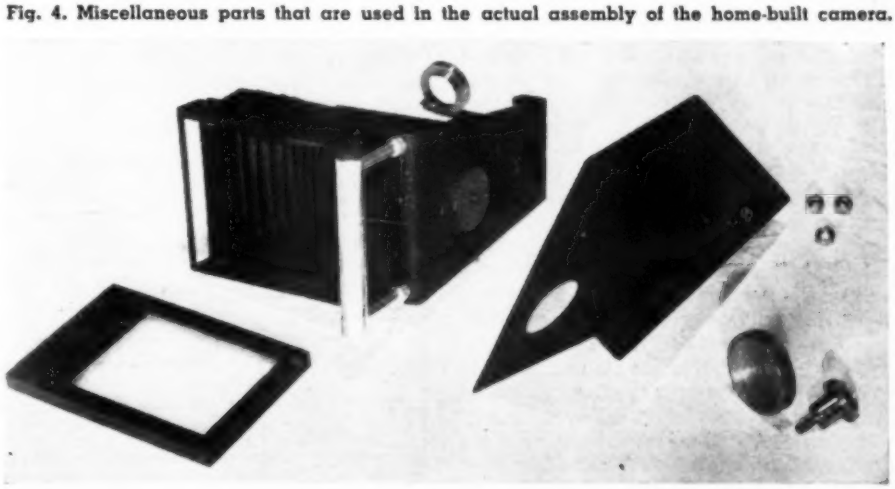
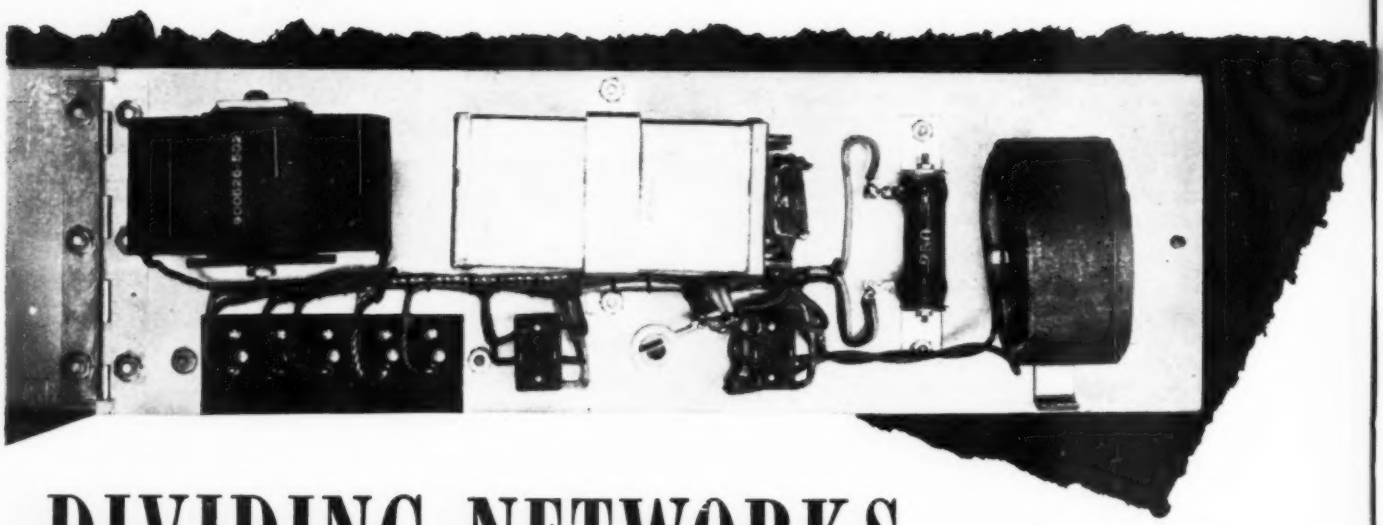


Fig. 3. Actual full-size reproductions of oscilloscope patterns taken by several different types of cameras. Note the wide variations in over-all height obtained.

Fig. 4. Miscellaneous parts that are used in the actual assembly of the home-built camera.





This is an interior view of an RCA type of dividing network for theater use. The crossover frequency is 400 c.p.s.

DIVIDING NETWORKS

By HAROLD RENNE
Technical Editor, RADIO & TELEVISION NEWS

A two-speaker system using a tweeter and a woofer has many advantages over a single speaker system.

BECAUSE of the difficulty in manufacturing a speaker with a single cone assembly which will satisfactorily reproduce both the extreme low and extreme high audio frequencies, it has become rather common practice to use a dual speaker system for high-quality installations. In such installations, a low-frequency speaker, or woofer, is used which is designed primarily to satisfactorily reproduce low frequencies, and a high frequency speaker, or tweeter, is used which is designed for the high frequencies.

It is desirable in systems of this nature to "sort out" the low frequencies from the high frequencies and apply each to the proper speaker. A network for performing this function is called a *dividing network,* and the point at which the frequency division takes place is called the *crossover frequency.* This is the frequency at which the two speakers receive equal amounts of energy.

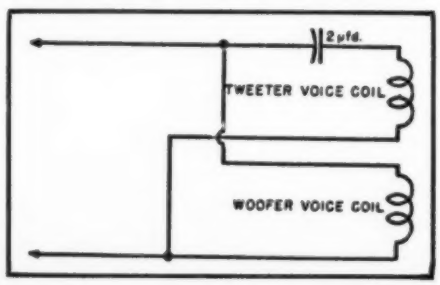
Experience has indicated that a dividing network should have an attenuation beyond the crossover frequency of from 6 to 12 db. per octave. This may be accomplished with fairly simple networks. Two types of circuits may be used: the filter network and the constant-resistance network. Both have advantages and disadvantages, and both will be discussed.

Fig. 2 shows parallel and series filter dividing networks, made up of half-section elements of the so-called *m*-derived type. Full section elements could be used, giving an attenuation of 18 db. per octave beyond the crossover frequency, but the slight improvement in operation is not worth the additional cost and losses involved. With extreme care in design, a dividing network may introduce as little as .5 db. power loss, but even this can become appreciable when high powers are involved. For example, at a power level of 100 watts, a .5 db. loss represents a power loss of about 11 watts.

The equations in Fig. 2 indicate how the condenser and inductance values may be determined. The value of R_o indicates the impedance of each of the speakers and the input impedance to the network. The crossover frequency f_c is determined by the speakers used and should be as low as possible. Each speaker should be able to contribute appreciably to the sound output at least one-half octave beyond the crossover frequency.

The filter-type dividing network is somewhat more versatile than the constant-resistance type and has slightly better transmission characteristics in both the transmission and attenuation bands. It does not lend itself readily to mass-production techniques, however, as two different values of inductance and capacity are required.

Fig. 1. Schematic of a simple dividing network which will operate quite satisfactorily.



Both the parallel and series type of networks are effective, but listening tests seem to favor the series type (Fig. 2B).

It might be instructive to calculate a typical dividing network on the basis of the circuit and equations given in Fig. 2. For the reasons given before, we will choose the series type for our calculations. A typical value for the speaker and input impedances would be 8 ohms, and the crossover frequency will be chosen as 800 cycles. Substituting these values in the proper equations gives the following constants for the network:

$L_2 = 1.6$ mhy. $\quad C_3 = 40$ μfd.
$L_3 = 1.0$ mhy. $\quad C_1 = 25$ μfd.

The inductances should be wound with fairly heavy wire on a nonmagnetic coil form, such as wood. An inductance bridge is very helpful in obtaining the correct values. The coils should be mounted with their axes perpendicular to avoid mutual coupling. The condensers must not be of the electrolytic type, but they may be paper or oil-filled. Some condensers available on the surplus market would be suitable. Observers report that the calculated values of inductance and capacity may be varied as much as 25% without any appreciable effect on reproduction as judged by listening tests.

The constant-resistance type of dividing network is shown in Fig. 3. It will be noted that for a given network, the values of the two inductances and the two condensers are the same, making this unit easier and cheaper to build on a production basis. When properly designed, this network is equally as effective as the filter type. It has the theoretical advantage of presenting a constant load to the source at all frequencies, but the wide variation in impedance of the voice coils with frequency tends to defeat this advantage.

Either of the networks shown will

give an attenuation of about 12 db. per octave beyond the crossover frequency and will introduce a power loss of between .5 and 1 db. An attenuation of 18 db. per octave may be obtained by the use of π or T sections instead of L sections, but such attenuation is not essential, and, as with the filter type, the additional power loss resulting from introducing the additional components more than outweighs any advantage that might be obtained.

As an example of a typical series-type constant resistance dividing network (Fig. 3B) let us take the same conditions as before, namely, $R_0 = 8$ ohms, $f_c = 800$ cycles. This gives values for L_2 of 1.1. mhy. and C_2 of 31 μfd.

A much simpler dividing network than those described above is frequently used. This network is shown in Fig. 1 and consists simply of a 2 μfd. condenser in series with the voice coil of the tweeter. The inductance of the woofer voice coil is appreciable, and its impedance rises with frequency. The inductance of the tweeter voice coil is relatively small, so the impedance of the condenser-voice-coil series combination decreases as the frequency increases. These two effects tend to cancel each other, giving a fairly constant impedance.

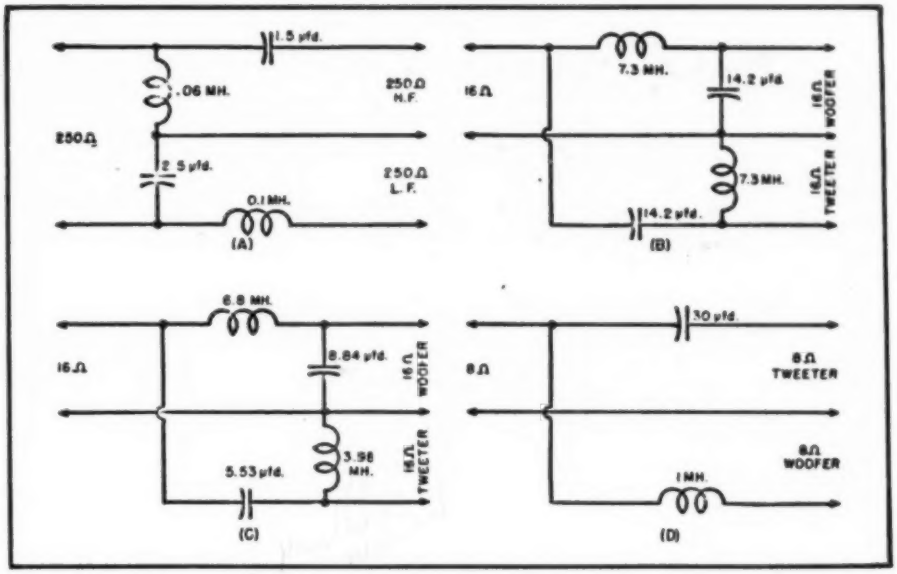
In the above discussion, we have ignored the fact that the tweeter speaker is, in general, more efficient than the woofer. This would tend to give an unbalanced output with excessive high frequencies. For this reason, an attenuator is usually placed in the tweeter circuit to compensate for this increased efficiency.

We have assumed in our dividing network calculations that the voice coil impedance of the tweeter and of the woofer were the same. If such is not the case, the problem is considerably more complicated. If the tweeter voice coil impedance is higher, it may be shunted by a resistor, within limits, to bring the impedance down to the correct value. For example, if the woofer has an 8 ohm impedance and the tweeter is rated at 16 ohms, a 16 ohm resistor may be connected in parallel with the tweeter to bring the total impedance down to 8 ohms. Half of the high-frequency power is lost in this resistor, but the higher tweeter efficiency may make up for this loss.

The above discussion has assumed that the dividing network is placed between the output transformer and the speakers. It is entirely possible to place this network in the center of the amplifier and then use separate power amplifier stages for the low and high frequencies. The network may be somewhat simplified since the value of R_0 may be greatly increased and since power loss in the network is no longer a vital consideration. These advantages may be overcome by the additional cost and complexity of the two separate power amplifier channels, but this system has been used with marked success in a commercial amplifier manufactured in England.

Another possibility is to place the dividing network in the plate circuit of the output stage, and then to use separate matching transformers for the high and low frequency speakers. This permits matching the network to any speaker impedance, and because the network is in a high impedance portion of the circuit, more convenient values of inductance and capacity are possible. At least one company using this latter system reports highly satisfactory results.

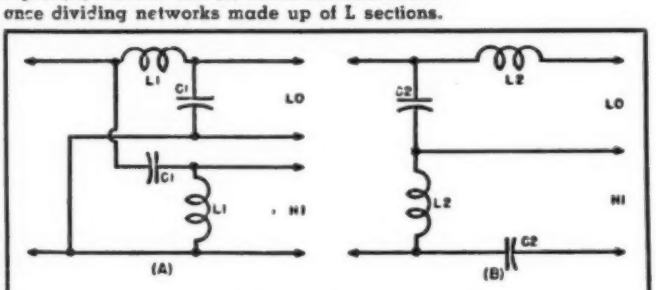
With good woofer and tweeter speakers, proper enclosures, and a suitable dividing network, frequency response from 50 to 15,000 cycles can be readily achieved. —30—



Some typical commercial dividing networks. (A) RCA network with 400 cycle crossover for theater use. (B) Brociner Electronics constant-resistance network with 500 cycle crossover and an attenuation of 12 db. per octave. (C) Circuit used by Stephens Mfg. Co. to give an attenuation of 12 db. per octave and a crossover of 600 cycles. (D) University Loudspeakers, Inc., network with 600 cycle crossover frequency.

Fig. 2. (A) Parallel and (B) series filter dividing networks made up of half-section elements.

Fig. 3. (A) Parallel and (B) series constant resistance dividing networks made up of L sections.

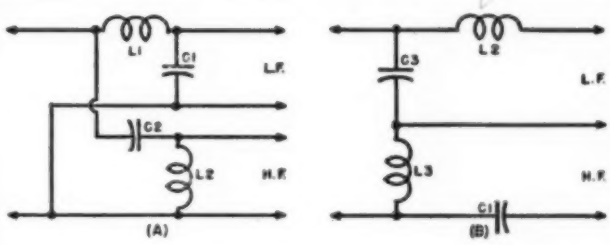


$$L_1 = \frac{\sqrt{2}\,R_0}{2\pi f_c} = \frac{228\,R_0}{f_c} \text{ mhy.}$$

$$L_2 = \frac{R_0}{2\pi\sqrt{2}\,f_c} = \frac{114\,R_0}{f_c} \text{ mhy.}$$

$$C_1 = \frac{1}{\sqrt{2}\,2\pi f_c R_0} = \frac{114{,}000}{f_c R_0} \text{ μfd.}$$

$$C_2 = \frac{\sqrt{2}}{2\pi f_c R_0} = \frac{228{,}000}{f_c R_0} \text{ μfd.}$$



$$L_1 = \frac{1.6\,R_0}{\omega_c} = \frac{255\,R_0}{f_c} \text{ mhy.}$$

$$L_2 = \frac{R_0}{\omega_c} = \frac{159\,R_0}{f_c} = \frac{L_1}{1.6} \text{ mhy.}$$

$$L_3 = \frac{R_0}{1.6\,\omega_c} = \frac{100\,R_0}{f_c} = \frac{L_2}{1.6} \text{ mhy.}$$

$$C_1 = \frac{1}{\omega_c R_0} = \frac{159{,}000}{R_0 f_c} \text{ μfd.}$$

$$C_2 = \frac{1}{1.6\,\omega_c R_0} = \frac{100{,}000}{R_0 f_c} = \frac{C_1}{1.6} \text{ μfd.}$$

$$C_3 = \frac{1.6}{\omega_c R_0} = \frac{255{,}000}{R_0 f_c} = 1.6\,C_1 \text{ μfd.}$$

Hints on Using Sweep Generators for TV RECEIVER ALIGNMENT

By
JOHN A. CORNELL
RCA Service Co., Inc.

Principles of visual alignment — its pitfalls and hints on how to avoid them.

RCA's television sweep generator.

VISUAL alignment of bandpass circuits, for many years an established technique in factories and development laboratories, has recently assumed considerable importance in the radio service industry due to the rigid requirements imposed by the tuned amplifiers used in television receivers. The principles of visual alignment, and the various methods of applying the principles, have been described in a great many technical articles and books. Seldom, however, have these sources given reasons for the ambiguities which are often evident when a radio technician attempts to align, by visual methods, a television receiver or, in fact, any other type of receiver. Many a service technician's faith in visual alignment technique has been shaken when, after following exactly the instructions in the service manuals and instruction books, he has obtained a response curve which appeared to him unlike anything described or shown in any of the books or articles, or anything that could be interpreted as a fault or misalignment in the receiver being aligned. Such puzzling results are sometimes obtained with one particular piece of test equipment and not another; indeed, with some test instruments in the lower-price brackets, confusion is commonplace.

It is the purpose of this article to interpret some of the apparently ambiguous curves sometimes seen on oscilloscopes in aligning amplifiers, and to tell whether such curves are due to the amplifier undergoing alignment or to the equipment and methods used to align it. Moreover, cures will be prescribed, and hints will be given which will make more uniform the results obtained from visual alignment. The cures will apply generally to some of the lower-priced test instruments which understandably are not as adequate as the higher-priced units capable of doing a more efficient job of alignment.

First, look at Fig. 3, which shows the equipment needed for performing a visual alignment and its connection to the television receiver. No marker generator is shown here, since in the interest of unity, this article will not be concerned with marker generators and their application. Nevertheless, a marker generator is a necessary part of the alignment equipment and should be used in a practical alignment job. An essential part of the test setup shown in Fig. 3 is the metal sheet, upon which rests all of the equipment and the receiver under test. Just why this metal sheet is important will be explained later.

Let us assume that the picture i.f. amplifier of the receiver is to be aligned, and that the oscilloscope and sweep generator are properly adjusted and connected to the proper points in the receiver. These points should be obtained from the manufacturer's service data for the receiver. Many modern sweep generators employ a sinusoidal sweep, so we will assume that the one shown in Fig. 3 does also. This means that the voltage fed to the picture i.f. amplifier is an r.f. wave swept through the i.f. passband at a 60-cycle, sine wave rate. Moreover, the voltage employed for horizontal deflection of the oscilloscope beam is a 60-cycle sine wave. If everything is operating properly, and if the amplifier under test is not badly out of alignment, a waveform similar to that shown in Fig. 1A will appear on the oscilloscope screen. When the sweep phase control on the sweep generator is properly adjusted, the two traces will overlap to produce the response curve shown in Fig. 1B.

Some sweep generators have a blanking switch which disables the oscillator during the time that it would normally sweep from the high-frequency end of the passband to the low-frequency end. When this blanking switch is thrown, the outputs of the sweep generator and, consequently, of the amplifier under test are zero during the return sweep time. The return trace on the scope is, therefore, a straight line representing zero response. Fig. 1C shows this. Whenever the blanking switch is used, the sweep phase control must first be properly set, then left alone.

The patterns of Fig. 1 indicate what should normally be seen during a visual alignment. Of course, these curves may be seen inverted and/or switched from left to right, depending upon the phasing of the sweep generator, the polarity of the signal across the load resistance, and the scope polarity. The service data for the particular receiver being aligned will indicate the various adjustments necessary to produce the normal response curves of Fig. 1. It is well understood that these patterns will be modified by various

degrees of misalignment in the amplifier under test.

What is not so well understood, however, is that in many cases the curve seen on the scope can differ radically from the true response of the amplifier even though the amplifier is perfectly aligned. In many of these instances, the radio technician performing the alignment will reason that the deviation of the curve from nomal is due to misalignment of the amplifier. He will then try to secure the proper response curve by making adjustments on the amplifier. Since the amplifier may not be at fault, any attempt at alignment may result in even further misalignment, thus leaving the technician in a most embarrassing situation. He will probably not be able to produce anything like an ideal response curve, or if he does, then the true response of the amplifier will be incorrect because he has unconsciously misaligned it in such a way as to compensate for deficiencies in either his method, the oscilloscope, or the sweep generator.

Now, let's see just what can make the curve shown on the scope differ from the true response of the amplifier. First, we'll determine the effect of the oscilloscope on the shape of the response. Fig. 2A shows the waveform of the voltage which would be fed to the vertical amplifier of the oscilloscope to produce the response shown in Fig. 1A or B. This waveform is not unlike a low-frequency square wave and, as such, it is not a particularly easy thing to pass through an amplifier undistorted. In fact, for an oscilloscope amplifier to pass this wave without distortion would require it to have a sine-wave response that is flat down to four or five cycles. A great many oscilloscopes in use today, and even some on the present market, do not meet this requirement, and they will naturally distort the waveform of Fig. 2A.

The nature of the distortion is shown in Fig. 2B. Notice the tilt on the normally flat horizontal portions of the wave. This tilt is due to low-frequency phase shift in the vertical amplifier of the oscilloscope. In a practical alignment setup, the waveform of Fig. 2B will be displayed on the scope as Fig. 2C. Notice the opposite tilts on the horizontal portions of the wave. Bear in mind that there is nothing wrong with the amplifier being aligned—the distortion of Fig. 2C is caused entirely by the oscilloscope. If the blanking switch on the sweep generator were turned on, the distortion would be still greater.

The sound i.f. amplifier normally has a response like that shown in Fig. 2E, but if the scope used to display the curve does not have good low-frequency response, the trace of Fig. 2D will be seen. Radio technicians who have done considerable visual alignment work with various makes of test equipment will doubtless recognize the trace of Fig. 2D. Those who know the reason for the loops in the trace of Fig. 2D will ignore them and concentrate on the upper portion of the trace. When this upper portion is adjusted for maximum height and symmetry, the amplifier is properly aligned, regardless of the distorted lower portion of the trace. This procedure is not so simple in the case of the picture i.f. amplifier, however, as a glance at Fig. 2C will show. An experienced technician may be able to visualize how the trace of Fig. 2C would appear if there were no low-frequency distortion present in the oscilloscope, and so perform a fair alignment job, but it's a difficult and time-consuming process.

A far better solution is to improve the low-frequency response of the oscilloscope and thus be completely free from confusion as far as the scope is concerned. This can be done by replacing all of the coupling and screen bypass condensers in the scope with higher-capacity units. Also, the cathode bypass condensers should be increased to about 500 μfd., or removed altogether. The latter alternative will decrease the gain of the scope. The same type of distortion may be encountered even with a scope having good low-frequency response, if the waveform fed to the vertical amplifier is not taken directly from the detector load resistance. If this waveform is taken from the output side of a coupling condenser, then that condenser, especially if it is low in capacity, may introduce low-frequency phase shift. A good rule to observe is always to take the waveform directly from the detector load, except when the manufacturer's instructions specify otherwise.

Now let's consider another source of confusion. Many technicians have noticed that the shape of the response curve seen on the scope will change if the chassis is touched, or if the test instrument cables are moved around, or if a hand is brought near any of the cables, test equipment, or the receiver. Sometimes, as a particular coil or transformer is being adjusted, the proper response will be obtained, only to be lost when the alignment tool is removed. This can happen even with non-metallic alignment tools.

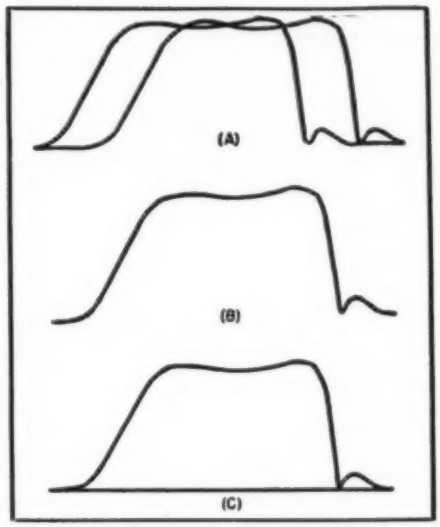


Fig. 1. Video i.f. response curves which indicate proper operation of receiver and test equipment. All curves are normal response of (A) phasing control improperly set, (B) phasing control properly set, and (C) blanking switch on generator "On."

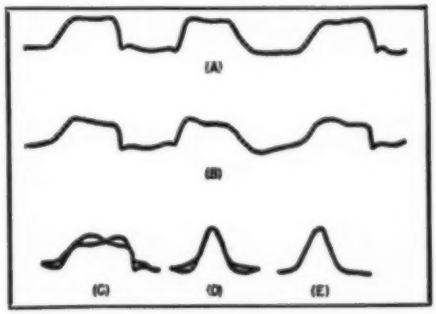
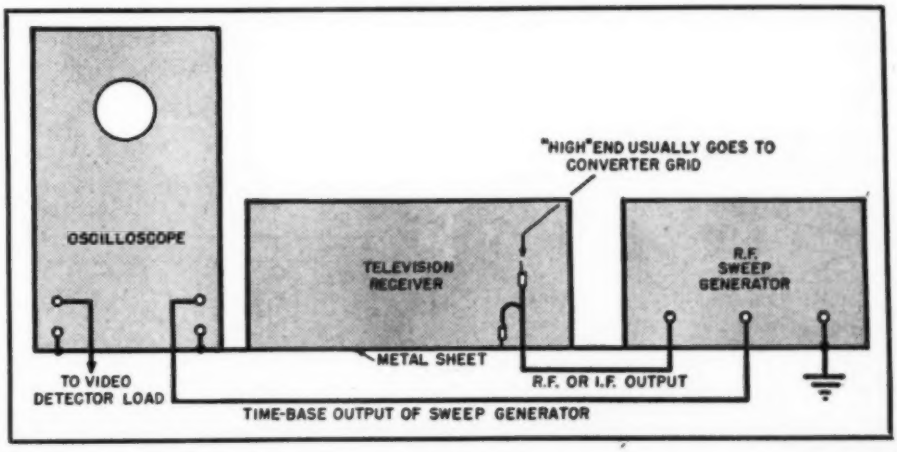


Fig. 2. Effect of oscilloscope on visual alignment waveforms. (A) Normal waveform fed to scope. (B) Distortion introduced if scope does not have good low-frequency response. (C) Effect of low-frequency distortion on normal response curve. (D) Effect of low-frequency distortion on normal response of sound i.f. amplifier. (E) Normal response of sound i.f. amplifier.

These effects, which are more noticeable on the higher-gain receivers, are usually caused by feedback from the receiver or the scope back into the power line and then into the sweep

Fig. 3. Test setup used for the visual alignment of television receivers.



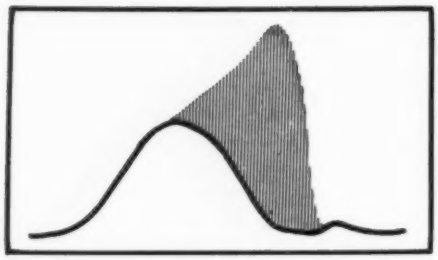


Fig. 4. Effect of oscillation of the picture i.f. amplifier as noted on response curve. The wide beat pattern shown will be seen only when an oscilloscope having good video frequency response is used. If the oscilloscope is not designed to have good video frequency response, then the beat pattern will be narrower, may look somewhat like a marker pip.

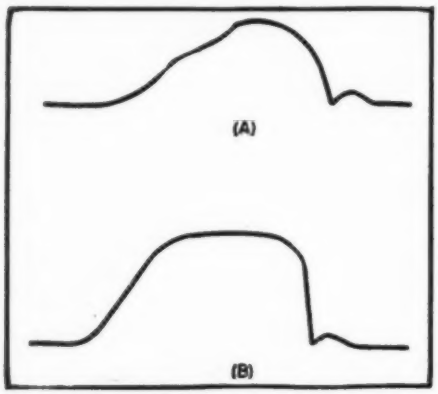


Fig. 5. Effect of overloading on shape of response curve. (A) Response curve of picture i.f. amplifier, showing poor alignment. (B) Response curve of same amplifier with sweep generator output turned up so as to overload amplifier. Notice the false indication of good alignment.

generator or an earlier stage in the receiver. The feedback causes regeneration (or even oscillation in some cases), which causes the entire test setup to become unstable and critical with respect to cable position and hand capacity. Actual oscillation of the amplifier will cause the curve to widen considerably at some point due to the beat produced, as shown in Fig. 4.

The cure for all of this instability is simple. Just place the scope, the receiver, and the sweep generator (also any other test equipment that may be used) on a large metal sheet, which should preferably be copper. Make sure that all units are in good electrical contact with the metal sheet or bypassed to it. Some test-equipment units are designed to fit into a special metal rack, which helps to minimize power-line coupling.

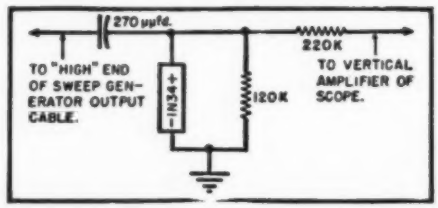
Another source of error in alignment may result from too much output from the sweep generator. In this event, one or more of the tubes in the amplifier being aligned may overload, or limit. This produces a flattening of the top of the response curve. Fig. 5 shows the effect of limiting on the true response of a picture i.f. amplifier. When overloading occurs, the radio technician will experience the false impression that alignment adjustments do not affect the top of the response curve. The flat top will also indicate that the response is good, although this may be far from correct. To avoid any errors due to overloading the amplifier under alignment, a simple procedure will be suggested.

Set the sweep generator output as low as possible, then gradually advance the output control. The trace on the scope will increase in height until, at some point, the top of the trace will start to flatten. This is the point at which the amplifier under test starts to overload or limit. Now decrease the output of the sweep generator until the trace is about half the height observed when flattening of the top first occurred. Set the scope gain control for a pattern of convenient height. As the alignment progresses, the trace will probably increase in height. When this happens, do not reduce the oscilloscope gain; rather, decrease the output of the sweep generator to maintain the trace at approximately half the limiting height or less.

Still another source of error in visual alignment occurs when the output of the sweep generator is not reasonably flat over the band of swept frequencies. This can be caused, for one thing, by not connecting the sweep generator properly to the receiver. In the first place, the output cable of the sweep generator must be terminated in its surge impedance, usually a resistance of about 75 ohms. The longer the cable, and the higher the frequency, the more important is the termination. In most modern sweep generators, this termination, or part of it, is included in the head of the cable, and as long as the cable is connected across an impedance in the receiver which is high compared to the termination, no difficulty should be experienced. This requirement is generally met with most television receivers except when the generator is connected to the antenna terminals of the receiver. Here, the impedance is usually either 75 or 300 ohms. In this case, the antenna input impedance, when added in parallel with the resistance already in the head of the cable, must terminate the cable in its surge impedance.

Methods of doing this, both for balanced and unbalanced inputs, are usually shown in the sweep generator instruction book. The leads from the sweep generator cable should be as short as it is possible to get them, or else lead resonance may cause a hump or a dip to appear on the response curve. In no case should any lead extensions be added to the leads already provided on the head of the cable.

Fig. 6. Diagram of a detector for checking sweep generator output for flatness.



When the output of the sweep generator is connected to the grid of an i.f. tube or to the converter, and that grid is at a negative potential, then the termination in the cable will short-circuit the grid potential. To avoid the consequent alteration in the operating characteristics of the stage, a small blocking condenser should be placed in series with the "high" end of the output cable. The blocking condenser, which should be a ceramic type of about 500 μμfd. capacity, must have very short leads (not over ¼ inch long).

Some of the lower-priced sweep generators, either through faulty design or some other defect, do not have an output which is constant over the swept band. Use of such a generator will cause the radio technician unknowingly to adjust an amplifier under alignment so that it compensates for deficiencies in the output of the sweep generator. This of course, will result in a poor alignment job, and what is worse, may to all appearances indicate to the technician that his faulty alignment job is good.

Some sweep generators obtain their output through frequency modulation of an oscillator whose center frequency is the same as that of the amplifier to be aligned. This type of generator can be checked for flatness before it is used. The check must be made on the same band of frequencies that will be used to align the amplifier after the check is completed. The method is to demodulate the output on the desired band and apply the resulting wave directly to the vertical amplifier of the scope. A suitable detector for this purpose is shown in Fig. 6.

All precautions about terminating the sweep generator cable and keeping leads as short as possible should be observed. If the output of the sweep generator is flat over the band of swept frequencies, then the detector output will be pure d.c., which will be displayed on the scope as a horizontal line. If the sweep generator blanking switch is turned on, then two parallel horizontal lines will be seen. One represents zero output; the other represents the d.c. output level of the detector. Any deviation from flatness in the output of the sweep generator will be shown on the scope as a curve, a tilt, or some irregularity on the line. The actual amount of deviation from flatness is evident when the blanking switch is turned on. If the sweep generator has no blanking switch, then the vertical input terminals of the scope can be momentarily short-circuited to simulate the blanking action. This will cause the trace on the scope to jump for an instant to the position representing zero level.

Any deviation from flat output, if evident, will be superimposed on the

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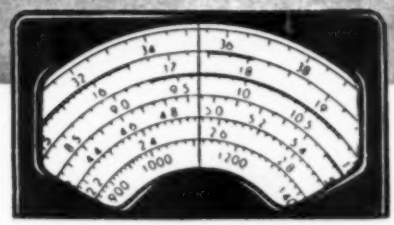
International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

IT IS indeed a pleasure this month to dedicate the *ISW DEPARTMENT* to the *"Voice of America."* Our thanks go to the State Department, and in particular to Roger Legge, New York, for the following data:

The United States first entered the field of international broadcasting on a sizable scale in 1940. The *"Voice of America"* was established under the Office of War Information to serve as a weapon of psychological warfare and as an instrument for projecting American news to Allied and neutral peoples.

With the end of the war, the psychological warfare activities were eliminated but the *"Voice of America"* continued broadcasting on a reduced scale under control of the Department of State. The purpose, as set forth by Public Law 402, 80th Congress, is "to promote the better understanding of the United States among the peoples of the world and to strengthen cooperative international relations."

The broadcasting operation is the responsibility of the International Broadcasting Division, Office of International Information, Department of State, and is under the jurisdiction of the Assistant Secretary of State for Public Affairs.

Programs are written, produced, and broadcast from studios in New York City and Washington.

The *"Voice of America"* beams to areas having a potential radio audience of 295,000,000.

The language schedule includes: To Europe, in Bulgarian, Czech, *English*, French, German, Greek, Hungarian, Italian, Polish, Rumanian, Russian, Serbo-Croat, Slovak, Slovene, and Spanish; to the Middle East, in Persian; to Latin America, in *English*, Portuguese, and Spanish; to the Far East, in Cantonese, *English*, Korean, Mandarin, and Russian: Addition of broadcasts in Arabic, Turkish, Hebrew, Ukrainian, and Swedish is planned.

Although accurate estimates are impossible, surveys, interviews, letters from listeners, and reports from U. S. overseas missions, political refugees, and American correspondents indicate a regular *"Voice of America"* audience of many millions. Letters from listeners totaled more than 100,000 in the past year.

On numerous occasions, news available only from these broadcasts has become widespread in countries where censorship prevented dissemination by any other media.

In April 1949, more than 200 Soviet transmitters began an intensive and expensive jamming campaign attempting to prevent the *"Voice of America"* from being heard by Russian listeners. To combat this jamming, the *"Voice of America"* increased substantially the number of programs in Russian and the number of transmitters per program.

The *"Voice of America"* uses 36 short-wave transmitters in the United States—ranging from 20 to 200 kilowatts power. These are located at or near New York City, New York; Boston, Massachusetts; Cincinnati, Ohio; San Francisco, California; Dixon, California; and Delano, California. They are operated by *The Associated Broadcasters, Inc.; Columbia Broadcasting System; The Crosley Corporation; General Electric Company; National Broadcasting Company; Westinghouse Radio Stations, Inc.;* and *World Wide Broadcasting Corporation.*

Short-wave relay transmitters include four of 75 to 100 kw. at Munich, Germany; two of 100 kw. at Honolulu, Hawaii; and two of 50 kw. at Manila, Philippines. Medium-wave relay transmitters in operation are one of 150 kw. at Munich, Germany, and one of 50 kw. at Manila, Philippines. Short-wave relay transmitters are under construction at Tangier. Short- and medium-wave relay facilities are leased from the BBC, London.

Broadcasting time is provided on the transmitters for the programs of the *Armed Forces Radio Service* and the *United Nations.*

The current frequency schedule of broadcasts of the *"Voice of America"* and the *Armed Forces Radio Service* is as follows:

Manila A, 920 kcs., 0500-1045 to East Asia; Munich A, 1195 kcs., 1030-2400 to Europe.

KNBI, 6.060, 0400-0915 to Hawaii-Australia; Munich III, 6.080, 1100-1730 to Europe; WLWO, 6.080, 1900-2100 to West South America; KCBA, 6.120, 2015-0330 to Alaska-Aleutians (AFRS), and 0400-0915 to Marianas-Philippines (AFRS); Munich I, 6.170, 1215-1730 to Europe; KNBA, 6.185, 0400-0915 to East Asia; Munich IV, 7.250, 1100-1730 to Europe; KCBR, 9.515, 0400-0915 to Philippines-East Indies; Manila III, 9.530, 1745-2000 to Far East; WGEO, 9.530, 1900-2200 to East South America; Munich II, 9.540, 1100-1730 to Europe; WNRA, 9.550, 1400-1730 to Europe; WKID, 9.570, 0700-0915 to East Asia; WRUW, 9.570, 1900-2000 to Central America; KWIX, 9.570, 2015-0315 to Alaska-Aleutians (AFRS); KRHO, 9.650, 0400-0915 to East Asia; WABC, 9.650, 1700-1730 to Europe; KGEI,

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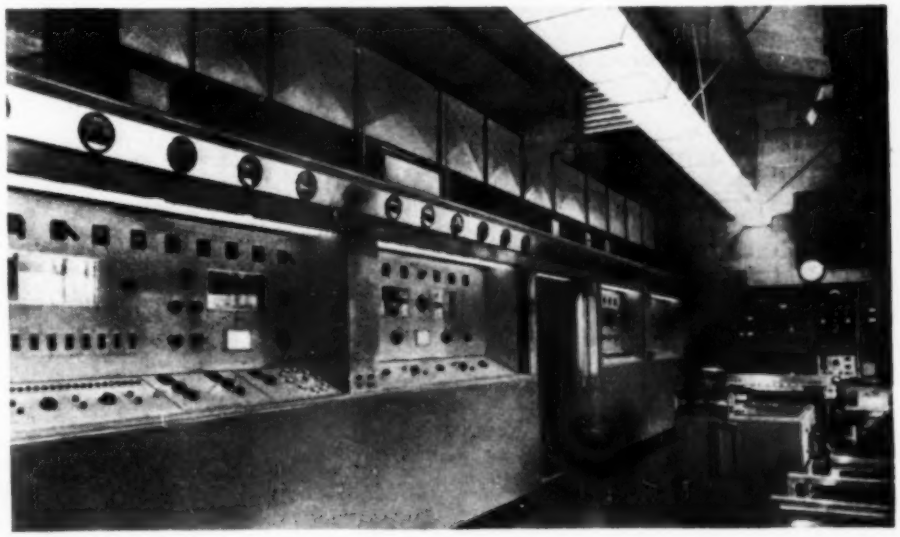
The 100 kw. General Electric transmitter of KRHO, the "Voice of America" outlet in Honolulu.



(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.)

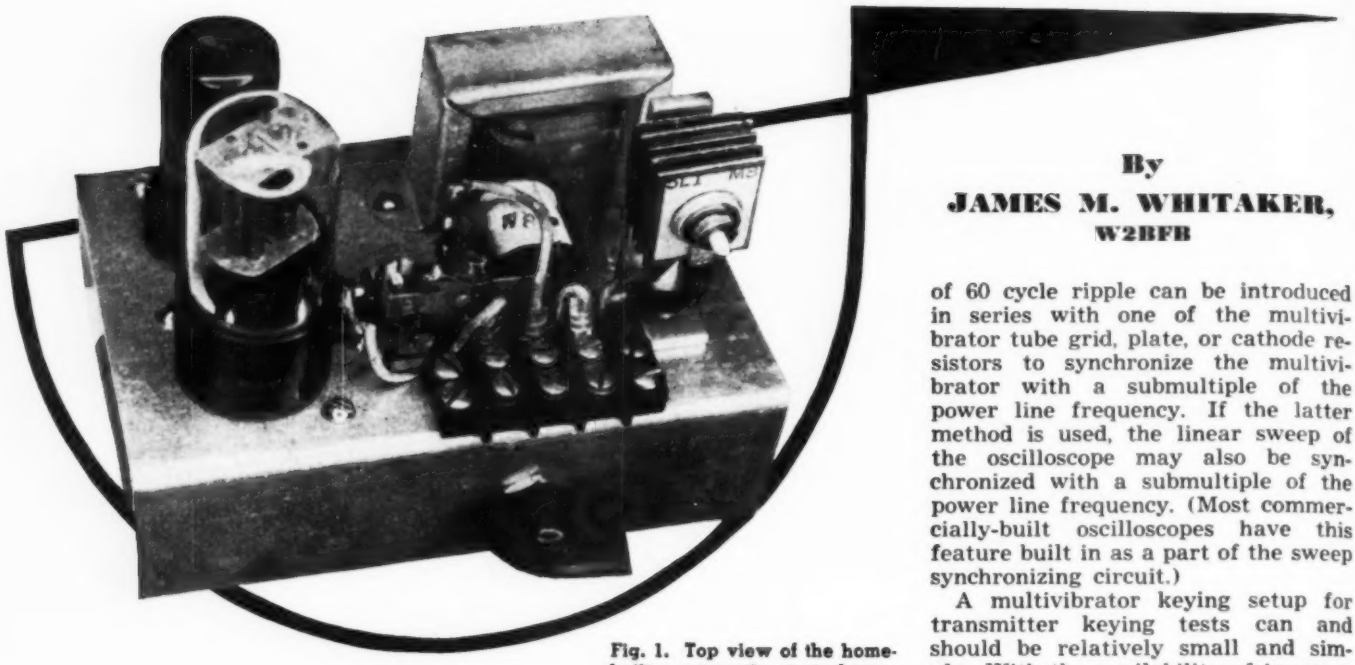


Fig. 1. Top view of the home-built, automatic test keyer.

An Automatic TEST KEYER

Details for constructing and operating an instrument designed to facilitate the observation of the keyed output of radio transmitters. It provides a means for keying the transmitter at a constant rate anywhere between 10 and 150 words-per-minute.

By
JAMES M. WHITAKER, W2BFB

THE PROPER adjustment of the keying system of a radio transmitter is best realized with the aid of a cathode-ray oscilloscope in much the same manner that the quality and depth of modulation is observed with the voice-modulated transmitter. In either case, the final amplifier is operated into a dummy load which approximates the normal antenna load. A pickup loop is then arranged to couple a sample of the r.f. output to the vertical plates of a cathode-ray oscilloscope, and the linear sweep is adjusted until the pattern formed by the modulation (or keying as the case may be) appears stationary on the face of the display tube. Adjustments are then made to produce the desired waveform and depth of modulation.

Adjustment of a telephone transmitter is relatively easy, insofar as obtaining a steady oscilloscopic pattern is concerned. A steady tone of a suitable frequency is applied to the modulator. The tone frequency is then adjusted until a satisfactory oscilloscope pattern is obtained. With the telegraph transmitter, the problem is more difficult. A keying rate which produces a satisfactory pattern is rather high for hand keying, and the dots must occur at an absolutely constant rate. Even a "bug" key, held over to the dot side, changes speed and dot length and is, therefore, not entirely satisfactory for this purpose. Motor-driven commutators have been used to produce a steady dot pattern, but even those devices have a tendency to be somewhat unsteady.

The most satisfactory solution to the problem of providing steady dots for test keying is the use of a simple multivibrator-driven relay. A multivibrator can be made very stable. It can also be made to cover a rather wide range of frequencies. It will maintain a uniform ratio of mark to space over its frequency range, and with the aid of an additional tube, it can produce a square wave admirably suited to operating a high-speed keying relay. The inductive surge across the relay coil can be used to synchronize the linear sweep of the oscilloscope with the keying pulses, or a slight amount of 60 cycle ripple can be introduced in series with one of the multivibrator tube grid, plate, or cathode resistors to synchronize the multivibrator with a submultiple of the power line frequency. If the latter method is used, the linear sweep of the oscilloscope may also be synchronized with a submultiple of the power line frequency. (Most commercially-built oscilloscopes have this feature built in as a part of the sweep synchronizing circuit.)

A multivibrator keying setup for transmitter keying tests can and should be relatively small and simple. With the availability of inexpensive selenium rectifiers, the cost of such an instrument is negligible. Certainly it is well within the reach of the average amateur and should be a part of every amateur radio station, or at least available through a local radio club.

The multivibrator tube can be any one of several types of twin triode tubes such as the 6N7, 6SN7, 6F8-G, 12AU7, etc. Two separate triode tubes may also be used if desired. Generally it is preferable to use a twin triode instead of two triodes, for economy of space as well as cost. The signal shaping tube (which also drives the relay) is any handy triode such as the 6C5, or the approximate equivalent of the 6C5 triode.

The theory of the multivibrator is not unduly complicated and is described in numerous handboooks and other electronic texts. For this reason, we will describe only a few simple details particularly applicable to the keyer unit to be described.

Power consumed by the multivibrator and the relay driving tubes is quite low, eliminating the need for a heavy duty power supply and filter. A simple transformerless power supply system incorporating a half wave selenium rectifier followed by an *RC* filter network will be entirely adequate. The heaters of the tubes may be operated from a midget type filament transformer, or they may be series connected with a suitable resistor and operated directly from the power line if desired. If the latter system is used, it is suggested that the multivibrator consist of two triode-connected 50B5 tubes, followed by a 12J5GT amplifier. The heaters may then be series connected, and the total heater voltage required will be 112 volts, which will just about match any standard power line within the permissible 10 per-cent.

The complete keyer is shown schematically in Fig. 2. Note that a low

value of resistance, R_{10}, is connected between the line and the selenium rectifier. It is important that some resistance be connected in this portion of the circuit to limit the peak charging current to a safe value. Selenium rectifiers are wonderfully trouble-free components if given a chance to perform, but they cannot stand the very high charging currents present if there is substantially no resistance in the circuit.

The keying frequency is increased or decreased by the adjustment of dual potentiometer R_4-R_6. Auxiliary resistors R_3 and R_7 are connected in series between the two sections of the dual potentiometer and the multivibrator grids to limit the variation of resistance in the grid circuits to a minimum consistent with satisfactory operation. The frequency range of the multivibrator can be increased by reducing the values of R_3 and R_7, but the operation of the multivibrator would be impaired by so doing. The range with the values shown is from 10 to 150 words-per-minute equivalent keying speed, which is more than ample for the purpose intended. For higher speeds, C_1 and C_2 may be changed to lower values.

Resistor R_8 provides cathode bias to limit the multivibrator plate current. It also provides a very nice means for injecting a synchronizing potential if desired. A small condenser connected between either end of R_{10} and the cathode side of R_8 will provide a means for synchronizing the multivibrator at any odd or even submultiple of the line frequency within the range of the instrument.

The grid of the signal shaping tube is connected to the grid of one of the multivibrator tubes through a 1 megohm resistor. This resistor prevents the signal shaping tube from drawing excessive grid current and thereby unbalancing the multivibrator during the positive excursion of the multivibrator pulse. The cathode resistor R_9 in the signal shaping tube circuit may be adjusted to provide the desired amount of drive current to operate the relay RL_1. The value of this resistor will have little effect on the signal shaping action of the tube, as the grid is driven positive to saturation and negative to cut-off on each alternate half cycle from the multivibrator. The value indicated is correct for the relay specified.

One simple mechanical arrangement is shown in Figs. 1 and 3. These are top and bottom views, respectively, of the unit in use at W2BFB. Note that the three contacts of the relay are brought out to terminals.

With such an instrument available, it is possible to realize a very fine adjustment of the transmitter keying. Just a few hints on this subject might be in order at this point. Make all keying adjustments with the normal load applied to the final amplifier. A change in load may change the keying envelope materially. (Try tuning the p.a. plate tank or changing the load in any way while running keying checks with an oscilloscope, and you will be amazed!) If the transmitter is keyed at some low level point, remember that a perfect waveshape at the keyed point is no guarantee of a perfect keying waveform after the signal passes through one or more "Class C" amplifier or multiplier stages.

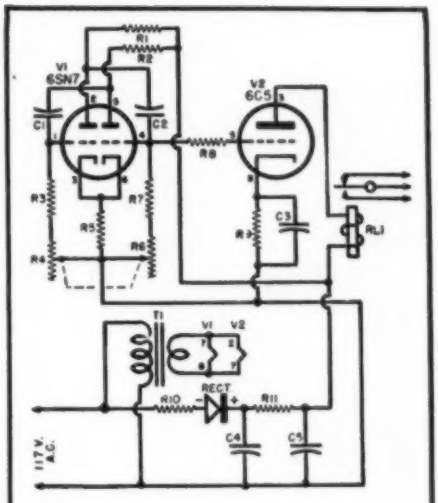
If sharp "spikes" appear at the beginning or end of the keying pulse, they may or may not be parasitic oscillations. If they are due to some low-frequency phenomena, increase the keying speed and you may be able to observe the waveform of the "spikes" and thereby determine the cause. Clicking and thumping keying is inexcusable, and every amateur is duty bound to clean up any such irregularities. A good variable speed automatic keyer, plus a cathode-ray oscilloscope, will go a long way toward removing the drudgery of locating and correcting faulty keying.

Correction of keying faults can be made by the conventional methods of using inductance, capacity, and resistance to delay the rise and fall of the keyed signal. The various radio handbooks have chapters devoted to the various methods, and there would be little point in repeating these methods here. The results of the changes in component values, however, can be readily seen.

It is sometimes desirable to know the exact equivalent words-per-minute represented by the keying "dots" or pulses. Equally spaced on and off dot cycles in terms of cycles-per-second, when multiplied by 2.5, equal International Morse keying speeds in terms of words-per-minute. For example: Let us assume that the multivibrator in the keyer described is operating at ten cycles-per-second. The transmitter is keyed on and off ten times each second with equal mark and space periods. The equivalent keying speed is 25 words-per-minute, in terms of the International Morse code. Likewise, it is a simple matter to convert words-per-minute into terms of dot cycles-per-second by dividing words-per-minute by 2.5.

The highest operating speed normally encountered in amateur radio telegraphy is probably on the order of 30 words-per-minute. The multivibrator can be easily synchronized with the power line frequency at 15 c.p.s., which will produce 37.5 w.p.m. equivalent keying. If the transmitter will faithfully follow keying at this speed, the keying will be clear and crisp at all hand speeds.

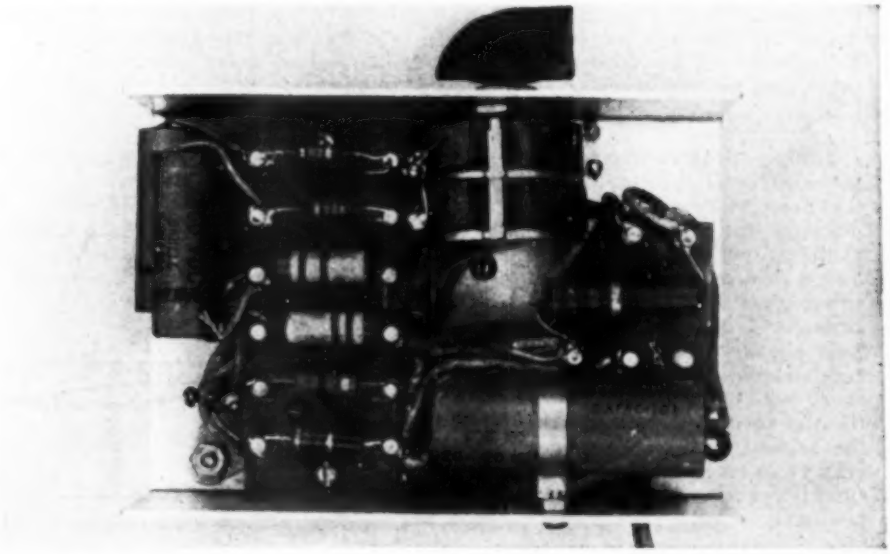
-30-



R_1, R_2, R_8—1 megohm, ½ w. res.
R_3, R_7—47,000 ohm, ½ w. res.
R_4, R_6—250,000 ohm dual pot.
R_5—500 ohm, 1 w. res.
R_9—200 ohm, 1 w. res.
R_{10}—25 ohm, 5 w. wirewound res.
R_{11}—1500 ohm, 2 w. res.
C_1, C_2—.01 μfd., 200 v. cond.
C_3—100 μfd., 50 v. dry elec. cond.
C_4, C_5—20 μfd., 150 v. elec. cond.
RL_1—Sigma type 4F, 8000 ohm relay
Rect.—"Selectron" type 5L1 selenium rectifier
T_1—6.3 v. @ 1 amp. fil. trans.
V_1—6SN7 tube
V_2—6C5 tube

Fig. 2. Diagram of the multivibrator keying circuit. Selenium rectifier type of power supply simplifies construction.

Fig. 3. Bottom view of test keyer, showing placement of under-chassis components.



NEED FOR FAST ACTING A.G.C. SYSTEM

By WALTER H. BUCHSBAUM
Chief Dev. Eng., Tech-Master Products Co.

Complete details on a new keyed automatic gain control for television receivers.

IN THE constant search to give the public better and more foolproof television receivers, it was found that an automatic gain control system for the picture i.f. amplifier and the r.f. amplifier is a great help in preventing overloading and many types of fading.

Practically all 1949 television receivers feature some automatic gain control system. Most of these circuits operate on the same principle as the automatic volume control system found in every radio receiver. A portion of the i.f. signal is rectified and filtered in such a manner that a negative d.c. voltage is obtained. This voltage varies in amplitude as the i.f. signal varies, and therefore when a very strong signal is received, a larger negative voltage results. The grid returns of several i.f. and r.f stages are connected to this bias voltage. Thus a very strong signal generates a more negative bias which, in turn, reduces the gain of the stages connected to it.

The type of automatic gain control outlined above is fairly satisfactory when all stations can be received with a minimum of noise, and changes in signal strength are relatively slow. The filter networks which smooth out the rectified i.f. signal to produce the desired d.c. bias must have a long enough time constant to filter out the 60 cycle synchronizing pulses. Therefore, when the change in signal strength occurs in about 1/60 of a second, the bias voltage will not be changed at all. This is one of the major drawbacks when fading is due to reflected signals from airplanes or other fast moving objects.

Noise

Another drawback is present when the noise level of a signal is very high; the noise itself will produce a more negative bias and thus reduce the gain of the r.f. and i.f. stages. This, in turn, means less amplification for the desired signal and a lower signal-to-noise ratio.

In areas where a weak station is received with a lot of noise riding in there will be a tendency to suppress the television signal altogether, since the noise pulses can produce a bias voltage so large that the already weak signal does not receive sufficient amplification.

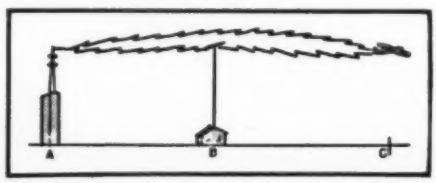
To appreciate the effect of noise on television reception, the various sources of noise and their effects must be clearly understood. Two main types of noise can mar television pictures: man-made noise and so-called "static" noise.

Man-made noise originates in any of the great variety of electrical appliances, such as vacuum cleaners, refrigerators, pumps, automobile ignition, electrical machines of all sorts, and the many mechanical devices which create electricity through friction or electrostatic action. In general, man-made noise is distinguished by some regularity in its appearance.

"Static" noise is considered to be caused by different natural forces, such as the action of the sun, weather conditions, static charges resulting in lightning and thunder, and the influence of cosmic rays. Actually, it is found that the so-called "static" noise level is often highest in locations having large industrial establishments. In such areas it is hard to determine which is nature's and which is man's contribution to the noise picked up by the television antenna. It is true, however, that the noise grows less and less as the antenna is mounted higher and higher. One drawback in high antenna locations is the long lead-in required which itself tends to pick up noise.

In studying the appearance of the noise waveforms it is found that practically all types of noise consist of sharp pulses of very short duration. It is the average d.c. voltage obtained from the rectification and filtering of constantly recurring noise pulses that determines the bias on the amplifier tubes. A single noise pulse alone will not upset the bias at all, but where noise is continuous and strong enough to appear in the television picture it will also have an effect on the bias.

Fig. 1.



Airplane Flutter

When a television signal is reflected and reaches the receiving antenna exactly in phase with the direct signal, it will increase the amplitude of the total signal received. If the reflected signal is out of phase with the direct signal by about 180 degrees it will reduce the total signal received. When a radio wave is reflected from a moving object, the phase of the reflected signal changes as the object moves. This is called the "Doppler" effect and is used in certain types of radar where the speed of a plane is found by the phase or frequency difference of radio waves reflected by it.

A concrete example is the case of an airplane flying at 300 m.p.h., away from the receiving antenna, as illustrated in Fig. 1. For simplicity in calculating, let us assume that the transmitter, the airplane, and the receiving antenna are all of the same height. Obviously two different signals can be received at "B": one directly from the transmitter at "A," and one reflected from the plane at "C." Assume that the station broadcasts at 200 mc. The wavelength of this signal is then 1.5 meters. The speed of the airplane translated into the metric system is 135 meters per second; 135/1.5 gives 90 cycles per second. This, then, is the difference frequency created by the motion of the plane. As far as the receiving antenna is concerned, however, the difference frequency is twice 90 c.p.s. or 180 c.p.s., because in our example the plane moves away, not only from the transmitter, but also from the receiver. This "flutter" frequency is the frequency at which the signal strength of the total received

signal varies between the sum and difference of the two. Naturally, any a.g.c. system which is required to filter out variations occurring in 1/50 of a second cannot compensate for variations every 1/180 of a second.

Actual field tests have shown that the higher flutter frequencies encountered are about 100 c.p.s., due to the fact that the receiving antenna is never as high as the transmitter or an airplane and because of other practical considerations. Thus an a.g.c. system which could compensate for signal strength variations occurring in about 1/100 of a second and which would not be activated to any great extent by random noise pulses constitutes another great improvement in television reception.

Theory of Keyed A.G.C.

The various types of keyed a.g.c. now in use or in the process of development all operate on the same principles. The picture signal with the d.c. component present is fed to the grid of a pentode, usually type 6AU6, in such a manner that the synchronizing pulses drive the grid more positive. The cathode of this a.g.c. tube is about 90 to 145 volts, positive, with the plate at d.c. ground potential. A portion of the horizontal flyback pulse is applied to the plate through a coupling network from the flyback transformer. During the peak period of this pulse, the tube conducts since the plate is then made sufficiently positive with respect to the cathode. A voltage divider maintains the grid a few volts negative with respect to the cathode, biased closely to cut-off.

During the period of the sharp pulse on the plate, the synchronizing pulse which is part of the composite picture signal appears on the grid. This synchronizing pulse makes the grid more positive, permitting more plate current to flow. Thus the amount of plate current that flows during each flyback period depends on the amplitude of the horizontal synchronizing pulse.

Because the d.c. component of the picture signal is preserved, all synchronizing pulses are at the same level unless the strength of the received signal changes. The plate current of the a.g.c. tube is, therefore, independent of the picture modulation or of any noise pulses which are part of the picture. If noise pulses are present during the sync pulse period, they will have some effect on the plate current, but since the sync pulse represents just about 5% of the composite picture, only 5% of the total noise present can be effective. This is the reason for the good noise characteristic of keyed a.g.c. systems.

The plate current flows to ground through a high-value resistor shunted by a condenser. This *RC* combination must have a time constant only large enough to filter out the horizontal sweep frequency, which is 15,750 c.p.s. This is a much smaller time constant than that required in other types of a.g.c. systems where the 60 c.p.s. vertical synchronization pulse must also be filtered out. This short time constant is what gives the keyed a.g.c. its fast action.

Pulse and Voltages

Fig. 2 shows the appearance of the flyback pulse at the plate of the a.g.c. tube and the synchronization pulse on the grid. The sync pulse is drawn larger than it actually is in relation to the flyback pulse (about 1/50 the height of the flyback pulse) in order to present a clearer picture. The duration of both pulses in relation to the rest of the individual line has also been exaggerated in order to show their appearance. It can be seen from this illustration that the actual time during which the tube can draw current is shorter than the flyback time. The flyback pulse is really triangular, and the plate voltage becomes high enough only during the upper portion which is much narrower than the base. The synchronizing pulse, however, is more of a square wave, and the grid is, therefore, maintained at the sync pulse level slightly longer that the actual conduction period of the tube. This tends to compensate for slight time differences, but when the horizontal sweep is not in synchronism with the incoming signal, the pulses on the a.g.c. tube will also be out of step, and the a.g.c. bias will vary rapidly.

One very important feature in incorporating keyed a.g.c. in any television receiver is the fact that the d.c. component must be present in the composite picture signal applied to the a.g.c. tube, otherwise the grid voltage would not be the same during each successive flyback period. When the picture signal passes through a condenser the d.c. component is removed, and the synchronizing pulses

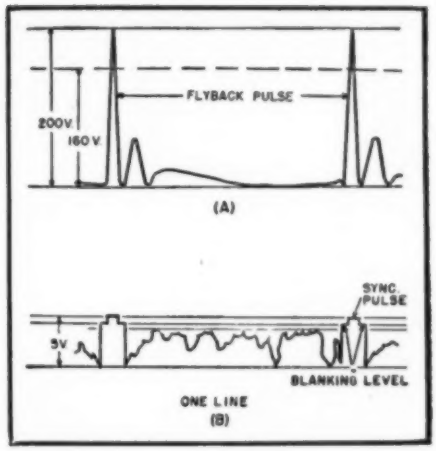


Fig. 2.

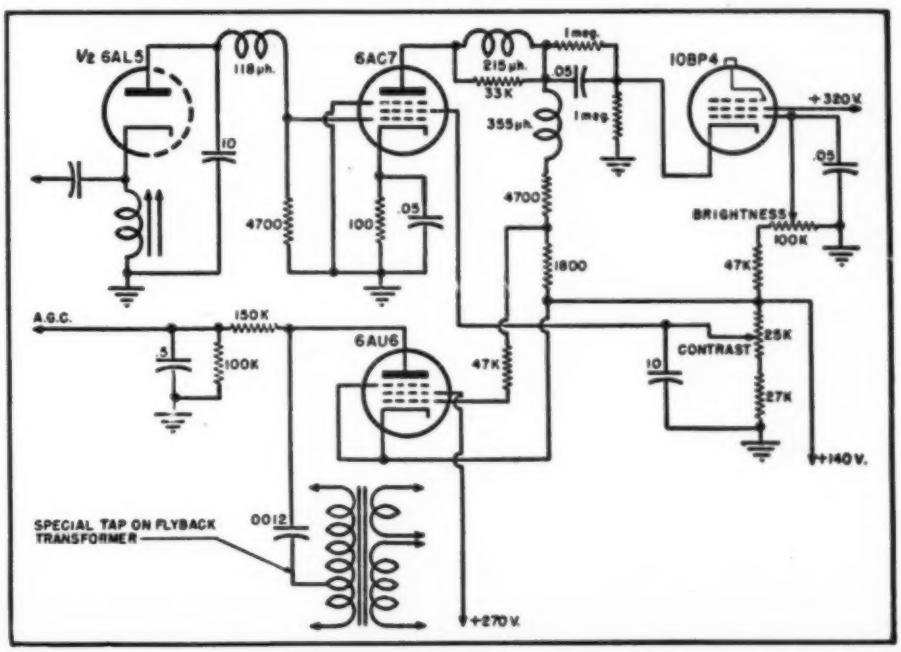
are no longer all at the same level.

D.c. restoration of various types is used on all television receivers prior to the picture tube. Some sets use a diode d.c. restorer, others use grid leak d.c. restoration in the last video amplifier and then make a direct connection to the picture tube. Still other models use a direct connection from the second detector to the video amplifier and then another direct connection to the picture tube, eliminating the need for d.c. restoration since the picture signal never passes through a condenser.

The second imporant feature in tapping the picture signal off to the a.g.c. tube is the fact that the synchronizing pulses must go in a positive direction. Whenever the picture signal is applied to the grid of the picture tube the sync pulses go negative. This is necessary so that the blanking pedestals, shown on both sides of the sync pulse in Fig. 2, can drive the grid negative and cut off the picture tube during the flyback time.

In receivers where the picture signal is applied to the cathode of the picture

Fig. 3.



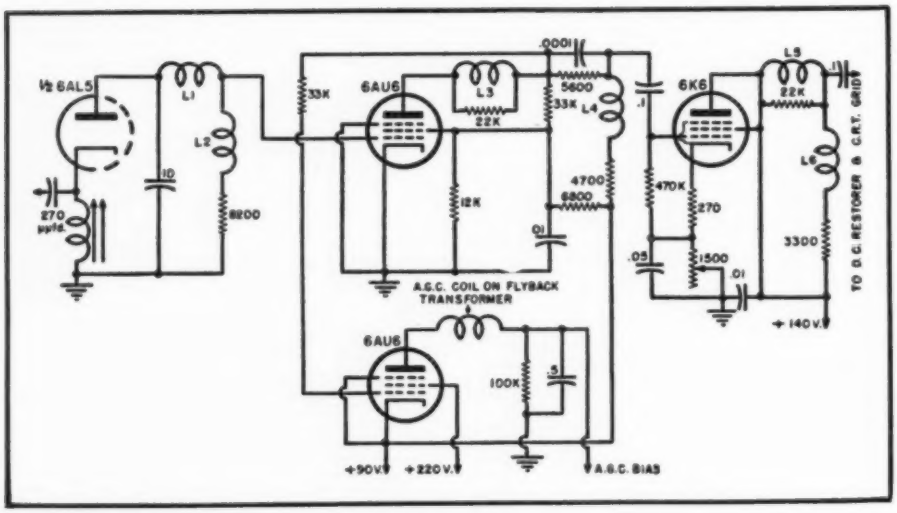


Fig. 4.

tube, the pulses go positive since they then make the cathode more positive with respect to the grid, again cutting off the tube during the flyback time. Therefore, it is possible to tap the picture signal from the last stage after d.c. restoration has taken place in all sets having cathode drive as shown in Fig. 3. When two stages of video amplification are used and the picture signal is applied to the grid of the picture tube, the proper tap-off point is in the plate circuit of the first video amplifier. In order to preserve the d.c. component in this case, a direct connection must be made from the second detector to the grid of the first video amplifier. This type of circuit is shown in the diagram of Fig. 4, the modification of an *RCA* Model 630 to keyed a.g.c.

Keyed A.G.C. Now in Use

While many manufacturers plan to incorporate keyed a.g.c. in their new models, a few are already marketing sets with this feature. The circuit in Fig. 4 shows the adaptation of the video stages of an *RCA* 630 receiver. Actually this video amplifier circuit is used, not only in the *RCA*, but in many other 1948 and 1949 models, and the same changes can be made there.

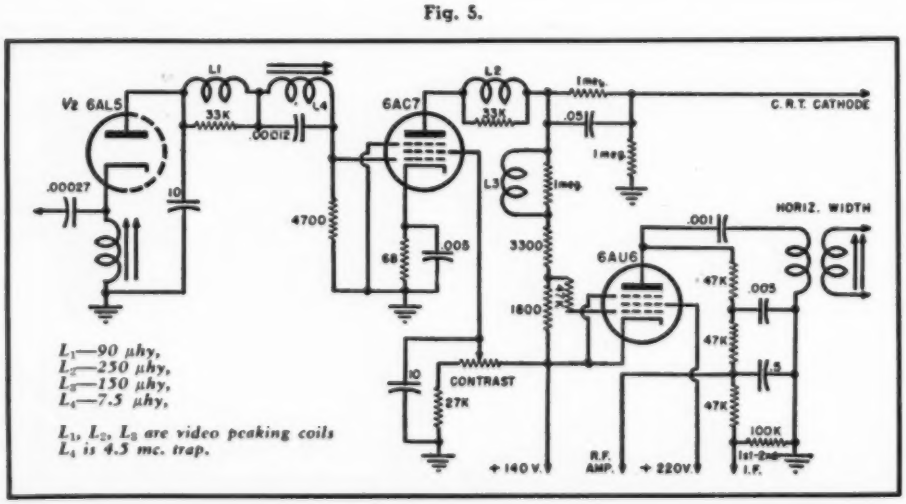
The first step in changing the circuit to keyed a.g.c. is to make a direct connection from the second detector to the grid of the first video amplifier. The original circuit calls for a 3 volt bias on that grid, but that can be neglected if the plate voltage of this tube is dropped to 90 volts. This also has the advantage that no special filament transformer is required for the a.g.c. tube since the cathode-to-filament potential is rated at about 100 volts.

The resistance network from the plate circuit of the first video amplifier to the a.g.c. tube is required to keep the tube capacity of the a.g.c. tube from altering the frequency response of the video stages. The 5600 ohm resistor shunted by the 100 μμfd. condenser are inserted to help equalize the video frequency response.

The next major change is to find a source for the flyback pulse to key the a.g.c. tube. In Fig. 4 an additional winding on the flyback transformer is used. This consists of about 80 turns of No. 34 enameled wire, wound on a 7/16 inch diameter form and slipped on the flyback transformer in the space between the main winding and the filament loop for the 1B3 high-voltage rectifier. The flyback transformer must be dismounted, the holding clamps removed, and the powdered iron core pushed out. Then the main winding and its bakelite form can be slid out, and the a.g.c. coil is easily slipped in place. Other sources of a suitable flyback pulse are shown in Fig. 3, and 5.

In place of the contrast control previously used a 1500 ohm potentiometer is connected in the cathode lead of the 6K6 video output tube as shown in Fig. 4. The .05 μfd. cathode bypass condenser should be located close to the cathode pin of the 6K6 and returned to the same ground as the .01 μfd. screen bypass condenser. If this is done a long lead can be brought to the contrast control mounted on the front panel.

Fig. 5.



Admiral Model 20A1

Another keyed a.g.c. system which is very effective is shown in Fig. 5; this is the circuit used in the *Admiral* sets, Models 20A1 and 20B1. A single stage of video amplification is used here, and the cathode of the picture tube is driven with the picture signal. Since a direct connection exists between the second detector and the video amplifier and then to the picture tube, no d.c. restoration is necessary. The picture signal is brought to the grid of the a.g.c. tube through a voltage divider and decoupling network, consisting of the 3300, 1800, and 47,000 ohm resistors in the plate circuit of the 6AC7 video amplifier. The cathode of the a.g.c. tube is connected directly to the 140 volts "B plus" point, and although this means that the cathode-to-filament potential is higher than rated, actual life tests have shown that as long as this is a d.c. potential no harm is done to the tube.

The screen grid of the a.g.c. tube is connected to a convenient source of about 220 volt d.c. The plate receives the flyback pulse through a 1000 μμfd. coupling condenser from a special winding over the horizontal width control. The other side of this winding is connected to ground and polarities are chosen so that a positive pulse reaches the plate of the a.g.c. tube. The advantage of using this special winding is in reduced cost in production since changes or additions in the flyback transformer are much more costly than another winding over the horizontal width coil. The contrast control consists of a voltage divider which determines the screen grid voltage of the 6AC7 video amplifier and thus the gain of that tube. The range of the contrast control is from about 65 to 140 volts which is sufficient to give a proper picture or cut off the video signal completely. The a.g.c. bias filter and voltage-divider are unconventional only inasmuch as a slightly larger bias is applied to the r.f. amplifier as to the grids of the first two i.f. stages.

New Videola Set

A variation of the keyed a.g.c. network used in *Admiral's* Models 20A1

(*Continued on page* 146)

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+ 8 to + 22 db
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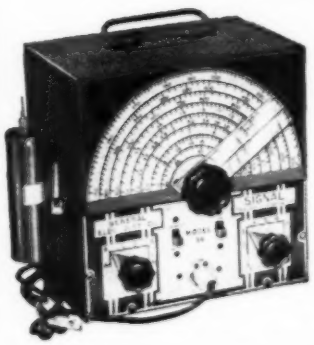
SIGNAL GENERATOR AND SIGNALTRACER



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MARS Station of the Month

MARS BEAMS WEEKLY BROADCASTS

MARS—Army Headquarters station, WAR, located at the Pentagon Building, Washington, D. C., broadcasts a weekly message each Tuesday at 0100Z and at 0200Z. (This is Monday at 8 p.m. and 11 p.m., Eastern Standard Time; Monday at 7 p.m. and 10 p.m., Central Standard Time; Monday at 6 p.m. and 9 p.m., Mountain Standard Time; and Monday at 5 p.m. and 8 p.m., Pacific Standard Time.)

Simultaneous broadcasts are made on frequencies 6997.5 kc., 14405 kc., and 20994 kc. Each message is sent three times, once at 10 words per minute, once at 15 words per minute, and once at 20 words per minute.

Designed especially to transmit quasi-official traffic and training information to MARS members, the broadcast offers an excellent opportunity to all amateurs in building up their code proficiency

K5FAB, the MARS station and center of amateur activity at Walker Air Force Base, Roswell, New Mexico, has been chosen as the "Station of the Month" by Major Rawleigh H. Ralls, Chief, MARS, Air Force. This selection was made on the basis of all round activity rather than on station operation, exclusively.

Major Larue D. "Rex" Rexroat, W5PJK, MARS Director for the 509th Bomb Wing (M), based at Walker, has furnished the drive and enthusiasm to develop the latent electronic urge in at least 18 aspirants into coveted FCC amateur licenses. Rex did not wait for Santa Claus to drop a parcel of surplus electronics gear into his lap. When he heard it was to become available he went after it. And once he got it back to the home base he made maximum use of it.

With the assistance of S/Sgt. Charley Suderno, W5OYB and chief op at K5FAB, the surplus gear was reduced to chassis and component bits and then reassembled into operable transmitters and receivers, by neophytes as well as the old gang who already had their tickets. To furnish the aspirant with proper incentive, once the transmitter was finished and checked against high amateur standards, it was placed on a shelf in the shack, where it remained until he received his FCC ticket. This procedure has been successful in seven operations to date with many more on the list.

Another item that helps the amateur program at Walker is that the "Boss Man" of the 509th Wing is W5PLT, Brigadier General Clarence S. Irvine. Ever since the General made his historic flight in 1946 in the "Pacusan Dreamboat" over the North Pole enroute from Hawaii to Cairo, Egypt, he has been an amateur enthusiast. It so happened that Lt. Col. Frank J. "Pappy" Shannon, Sr., W3QR, was radio op on this trip and Pappy did a nice job of indoctrination for the General spends every spare moment when at home on the air. You can't mistake his basso voice over the mike at W5PLT and the handle is "Bill."

While the transmitter that gets the

S/Sgt. Charles A. Suderno, chief op at K5FAB, twirls the dials in search of a 10 meter QSO. Charley is one of the old timers at Walker Air Force Base and holds the personal call W5OYB. He spends his spare moments with amateur aspirants in all phases of the game from code instruction to helping with design and construction.

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Calibrated main tuning has all important amateur, police, and foreign broadcast bands plainly marked. The NC-33 is finished in smooth gray enamel, with glareless translucent dials, and chrome trim. Size, 16⅛"x 8¾" x 8½". Operates from 105-125 volts, 40-60 cycles, AC, or 105-125 volts DC. Shpg. wt., 18 lbs.

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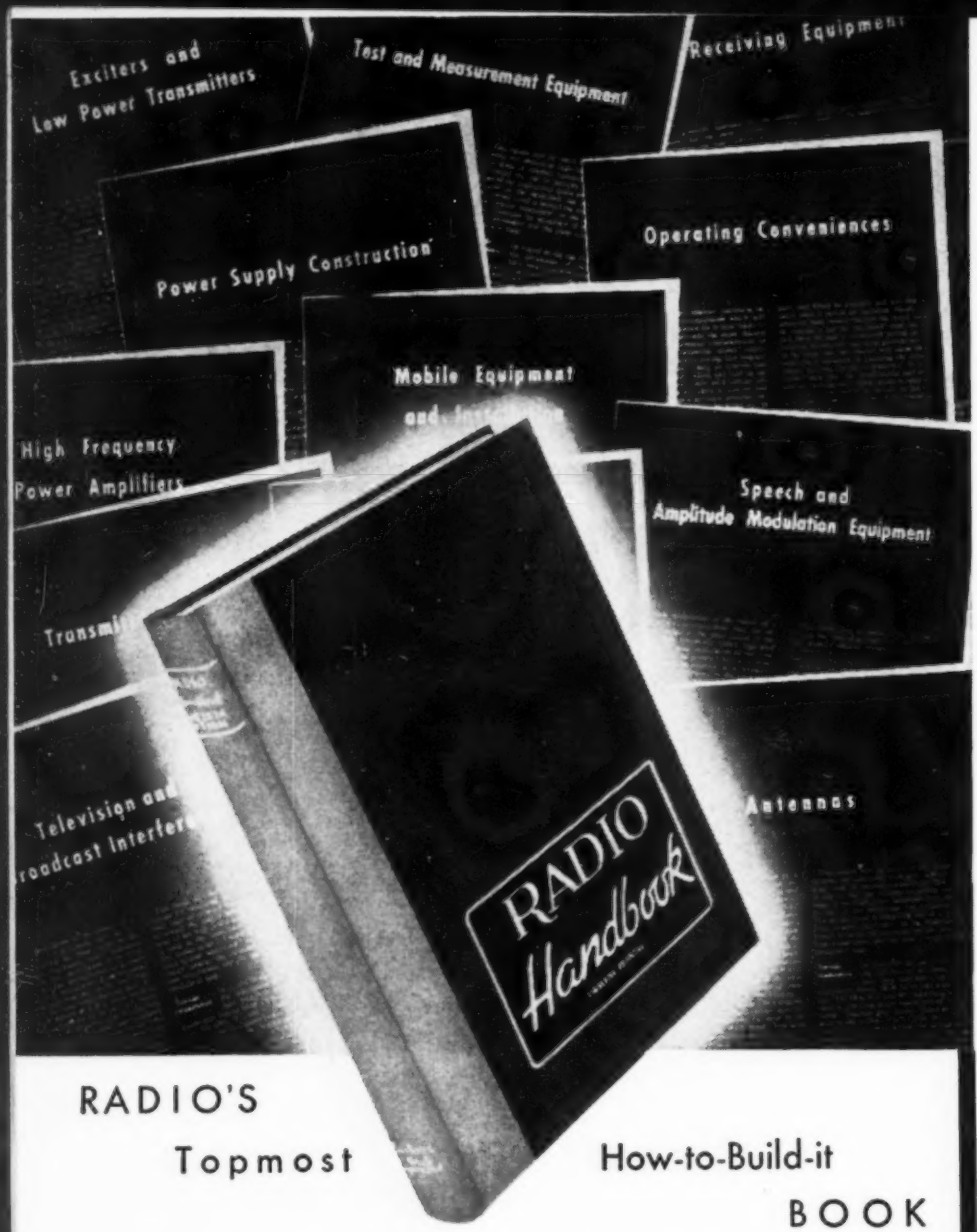

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heavy duty at K5FAB is the GI standard BC 610E there is a never-ending procession of rigs that one or another of the 22 MARS members has designed coming in for its checkout, from the 6L6 tri-tet that S/Sgt. Elmer Felio, W5PSC, put together for an outlay of $3.50 for parts he couldn't get out of MARS surpluses to the ART-13 that T/Sgt. Jerald Malone, W5QBG rescued from the salvage officer.

The ART-13 had a bum audio section so Jerry yanked it out, put in a few needed meters, a change here and there and cheers, he has 300 watts of cleanly keyed c.w. that knocked out QSO's to 10 U.S. zones, VE7 and CO2 in the first few hours of operation. It has since been given a coat of grey crackle enamel to give it that "Collins look" and is the pet of all the c.w. ops around the shack at K5FAB.

The standby receiving gear is an SX-28 and a "Super-Pro" with innovations from superregenerative receivers on 10 meters and up to variations of audio filters for the c.w. bands being brought in by the gadget and gismo boys for a check out. And a whole new outlay for 160 meters, 50 watts to the final, is one of Major Rexroat's pet projects.

Rex has also made a bid for harmonious relations with the civilian amateurs in Roswell by extending all of them an invitation to come out to the junior size hamfests held at Walker every first Monday. The invitation has been accepted by quite a number of Roswell hams.

Captain Charles J. Hartman, WØRIK, MARS Director for the Strategic Air Command, used the 509th Wing as a glowing example and as a criterion for other SAC Bases to follow.

—30—

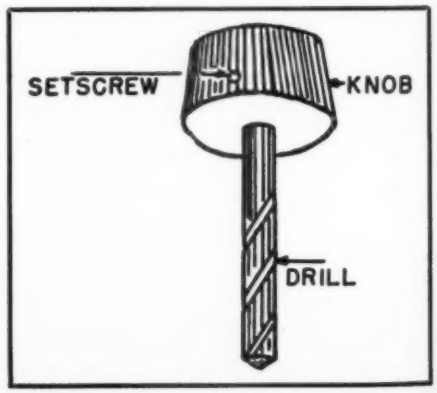
SMOOTH THOSE MOUNTING HOLES

By MILTON KALASHIAN, W1NXT

A FEW turns of a one-quarter-inch twist drill is a quick and easy way to take off the burrs that usually remain on the newly-drilled mounting holes on a chassis.

Hold the twist drill by inserting it in a large diameter radio knob that will take the standard one-quarter-inch shaft. —30—

Radio knob holds twist drill secure.



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New

...4½" 200 UA METER
...BALANCED AC CIRCUIT
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Quality GE tubes for long life

Beautiful 4½" streamline 200 ua meter

Varnish impregnated power transformer

Five highest quality controls for accuracy

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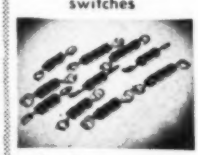

Precision ceramic divider resistors 1% accuracy

Features

- Meter scale 17% longer than average 4½" meter.
- Modern streamline 200 ua meter.
- New modern streamline styling.
- Burn-out proof meter circuit.
- 24 complete ranges.
- Isolated probe for dynamic testing.
- Most beautiful VTVM in America.
- Accessory probes (extra) extend ranges to 10,000 Volts and 100 Megacycles.
- Uses 1% precision ceramic divider resistors.
- Modern push-pull electronic voltmeter circuit.
- Electronic AC circuit. No current drawing rectifiers.
- Shatterproof plastic meter face.

The new Heathkit Model V-4 Vacuum Tube Voltmeter has dozens of improvements. The new modern streamlined 200 microampere meter uses Alnico V magnet for fast accurate readings. The streamlined case is molded of shatterproof plastic. The scales are long—17% longer than average 4½" meters and nearly twice as long as previous Heathkits.

The new electronic AC voltmeter circuit incorporates an entirely new balance control which allows a complete elimination of contact potential. This removes meter shift with various ranges, giving accurate readings on all ranges, and compensates for variations in tube elements. This feature is exclusive in Heathkits.

New simplified switching reduces by nearly one-half the number of connections made to the switches, giving easier, quicker assembly. New snap-in battery mounting for ohmmeter battery mounts on chassis for quick, easy replacement and simpler assembly.

The Heathkit VTVM with true electronic AC voltmeter and push-pull DC voltmeter circuit gives positive automatic meter protection on all functions.

The Heathkit is the only kit using precision ceramic permanent divider resistors instead of matched pairs of common carbon resistors which wander with age. The best laboratory meters available use the same ceramic resistors you find in your Heathkit.

The Heathkit VTVM is powered by a quality 110 V. 60 cycle varnish impregnated transformer manufactured by Chicago Transformer Corporation who produce some of the finest transformers used by the military services — you will find the best of materials in your Heathkit. A new power supply rectifier circuit greatly reduces the heat inside the cabinet to eliminate warm-up drift. Only the tremendous demand for Heathkit VTVM's would afford the fine engineering which has produced this new model. The Heathkit is the only VTVM Kit giving all the ranges. Check them: DC and AC full scale linear ranges of 0-3V., 0-10V., 0-30V., 0-100V., 0-300V., 0-1000V., and can be extended to 0-3000V., and 0-10,000V. DC with accessory probe at slight extra cost.

Electronic ohmmeter has six ranges measuring resistance accurately from one tenth of an ohm to one billion ohms, all with only two flashlight cells. The drain on the cells is so slight that they last for years.

Meter pointer can be offset from zero for FM and TV alignment.

The DC probe is isolated for dynamic measurements of receiver voltages without disturbing receiver operation. Constant 11 megohm input resistance allows use of standard accessories.

Has db scale for making gain—noise level and other measurements on audio amplifiers.

New instruction manual uses step-by-step instructions with pictorial diagrams for ease of assembly. The Heathkit VTVM is complete — light weight aluminum cabinet — all tubes — Mallory switches — power transformer — test leads — 1% precision resistors — beautiful two color panel—200 ua 4½" meter—instruction manual. A few hours work gives you the finest quality VTVM available — universities use them for atomic research — you will find it the handiest tool you'll ever own. Order now and enjoy it this entire winter season. Shipping Wt., 8 lbs. Model V-4.

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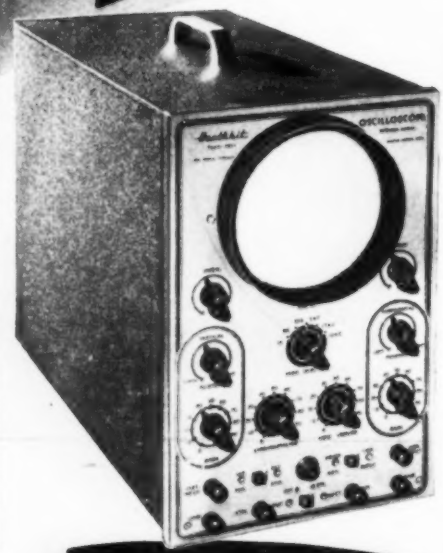

New 1950 Heathkit

PUSH-PULL EXTENDED RANGE 5" OSCILLOSCOPE KIT

Features

- The first truly television oscilloscope.
- Tremendous sensitivity .06 Volt RMS per inch deflection.
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- Useful frequency range to 2½ Megacycles.
- Extended sweep range 15 cycles to 70,000 cycles.
- New television type multivibrator sweep generator.
- New magnetic alloy shield included.
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The new 1950 Push-Pull 5" Oscilloscope has features that seem impossible in a $39.50 oscilloscope. Think of it—push-pull vertical and horizontal amplifiers with tremendous sensitivity only six one hundredths of a volt required for full inch of deflection. The weak impulses of television can be boosted to full size on the five inch screen. Traces you couldn't see before. Amazing frequency range clear useful response at 2½ Megacycles made possible by improved push-pull amplifiers. Only Heathkit Oscilloscopes have the frequency range required for television. New type multi-vibrator sweep generator with more than twice the frequency range. 15 cycles to 70,000 cycles will actually synchronize with 250,000 cycle signal. Dual positioning controls will move trace over any section of the screen for observation of any part. New magnetic alloy CR tube shield protects the instrument from outside fields. All the same high quality parts, cased electrostatically shielded power transformer, aluminum cabinet, all tubes and parts. New instruction manual now has complete step by step pictorials for easiest assembly. Shipping Weight 30 lbs. Order now for this winter's use.

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- All the convenient ranges 10–30–300–1,000–5,000 Volts.
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The instrument for all—the ranges you need—beauty you'll enjoy for years and you can assemble it in a matter of minutes—an instrument for everyone. The handiest quality voltohmeter of all. Small enough to put in your pocket yet a full 3" meter. Easy pictorial wiring diagrams eliminate all assembly problems. Uses only 1% precision ceramic divider resistors and wire wound shunts. Twelve different ranges. AC and DC ranges of 10–30–300–1,000–5,000 Volts. Ohms ranges of 0–3,000 ohms and 0–300,000 ohms. Milliampere ranges of 10MA and 100MA. Hearing aid type ohms adjust control fits conveniently under thumb for one hand adjustment. Banana type jacks for positive low resistance connections. Quality test leads included. The high quality Bradley instrument rectifier was especially chosen for linear scales on AC. The modern case was styled by Harrah Engineering for this instrument. The 400 microampere meter movement comes already mounted in the case protected from dust during assembly. An ideal classroom assembly instrument useful for a lifetime. Perfect for radio service calls, electricians, garage mechanics, students, amateurs and beginners in radio. The only quality voltohmeter under $20.00. An hour of assembly saves you one-half the cost and quality parts give you a better instrument. Order today. Shipping weight 2 lbs.

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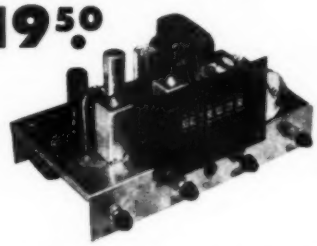

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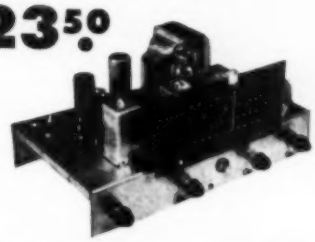

Two new Heathkit Superheterodynes featuring the best of design and material. Beautiful six inch slide rule dials — 110 V. 60 cy. AC power transformer operated—metal cased filters—quality output transformers, dual iron core metal can IF transformers — two gang tuning condenser. The chassis is provided with phono-radio switch—110 V. outlet for changer motor and phono pickup jack. Each kit is complete with all parts and detailed instruction booklet. Pictorial diagrams and step-by-step instructions make assembly quick and easy.

Ideal AC operated superheterodyne receiver for home use or replacement in console cabinet. Comes complete with attractive metal panel for cabinet mounting. Modern circuit uses 12K8 converter, 12SH7 input IF stage, 12C8 output IF stage and first audio 12A6 beam power output stage, 5Y3 rectifier. Excellent sensitivity for distant reception with selectivity which effectively separates adjacent stations.

The husky 110 V. cased power transformer is conservatively rated for long life.

The illuminated six inch slide rule dial is accurately calibrated for DX reception. Enjoy the pleasure of assembling your own fine home receiver. Has tone, volume, tuning and phono-radio controls. Chassis size 2¼" x 7" x 12½". Comes complete with all parts including quality output transformer to 3.4 ohm voice coil, tubes, instruction manual, etc. (less speaker). Shipping Wt., 10 lbs. No. BR-1 Receiver $19.50.

No. 335 Communications Type Table Model Metal Cabinet **$4.50**
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Separately assembled coil turret with band switch eliminates difficult construction. Conservatively rated 110 V. power transformer supplies full operating voltages to all tubes for maximum reception. Has band switch, tuning, volume, tone and phono-radio controls. Chassis size 2¼" x 7" x 12½" — supplied complete — punched chassis — tubes — controls — transformers (quality output to 3.4 ohm voice coil) — all small parts — hardware and instructions (less speaker). Shipping Wt., 10 lbs. No. AR-1 Receiver $23.50.

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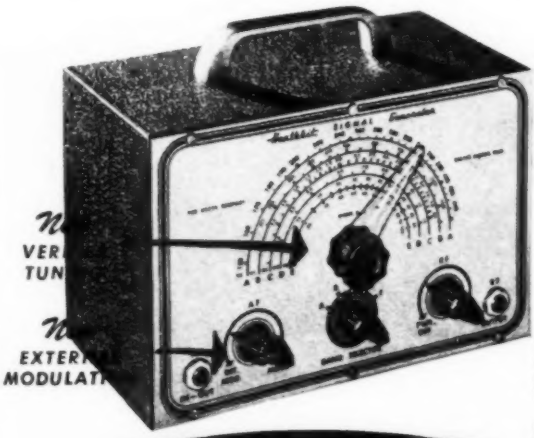

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Features

- New 5 to 1 ratio vernier tuning for ease and accuracy.
- New external modulation switch—use it for fidelity testing.
- New precision coils for greater output.
- Cathode follower output for greatest stability.
- 400 cycle audio available for audio testing.
- Most modern type R.F. oscillator.
- Covers 150Kc. to 34Mc. on fundamentals and calibrated strong harmonics to 102 Mc.

The most popular signal generator kit has been vastly improved—the experience of thousands combined to give you the best. Check the features in this fine generator and consider the low price $19.50. A best buy for any shop, yet inexpensive enough for hobbyists. Everyone can have an accurate controlled source of R.F. signal voltage.

The new features double the value—think of being able to make fidelity checks on receivers by inserting a variable audio signal. Internal 400 cycle saw-tooth audio oscillator modulates R.F. signal and is available externally for audio testing. The new 5 to 1 ratio vernier drive gives hairline tuning for maximum accuracy in scale settings. The coils are already precision wound and calibrated. Uses turret type coil and switch assembly for ease of construction. The generator is 110 V. 60 cycle transformer operated and comes complete in every detail—cabinet—tubes—coils—beautiful two color calibrated panel and all small parts—new step-by-step pictorial diagrams and complete instruction manual make assembly a cinch even for novices. Why try to get along without a signal generator when you can have the best for less than a twenty dollar bill. Better order it now. Shipping weight 7 lbs. **$19.50**

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Conversion kit for G-1 generators for vernier tuning and external modulation includes new high band coil for greater output. Gives all the features of new G-5 listed above. Order G-5 Conversion Kit No. 316 ..... **$4.50**

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A LABORATORY INSTRUMENT NOW WITHIN THE PRICE RANGE OF ALL

Measures Inductance from 10 microhenries to 100 henries capacitance from .00001 MFD to 1000 MFD. Resistance from .01 ohms to 10 megohms. Dissipation factor from .001 to 1. "Q" from 1 to 1000.

Ideal for schools, laboratories, service shops, serious experimentors.

An impedance bridge for everyone — the most useful instrument of all, which heretofore has been out of the price range of serious experimentors and service shops. Now at the lowest price possible. All highest quality parts. General Radio main calibrated control. General Radio 1000 cycle hummer. Mallory ceramic switches with 60 degree indexing — 200 micro-amp zero center galvanometer — ½ of 1% ceramic non-inductive decade resistors. Professional type binding posts with standard ¾" centers. Beautiful birch cabinet. Directly calibrated "Q" and dissipation factor scales. Ready calibrated capacity and inductance standards of *Silver* Mica, accurate to ½ of 1% and with dissipation factors of less than 30 parts in one million. Provisions on panel for external generator and detector. Measure all your unknowns the way laboratories do — with a bridge for accuracy and speed.

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No. 310. Extends range of any 11 megohm VTVM to 3,000 and 10,000 Volt ranges. A necessity for television. Shipping Wt., 1 pound. **$4.50**

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No. 309. Kit to assemble. R.F. probe extends VTVM range to 100 Mc. Complete with 1N34 crystal. Ship. Wt., 1 lb. **$6.50**

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Now a complete tool kit to assemble your Heathkit. Consists of Krauter diagonal cutters and pointed nose assembly pliers, Xcelite screwdriver, 60 Watt 110V. soldering iron and supply of solder. Shipping Wt., 2 lbs. Complete kit $5.95

New Heathkit
TELEVISION ALIGNMENT GENERATOR KIT

$39.50

Nothing ELSE TO BUY

Everything you want in a television alignment generator. A wide band sweep generator covering all TV frequencies 0 - 46 54 to 100 — 174 to 220 Megacycles, a marker indicator covering 19 to 42 Megacycles, AM modulation for RF alignment — variable calibrated sweep width 0 - 30 Mc. — mechanical driven inductive sweep. Husky 110V. 60 cycle power transformer operated — step type output attenuator with 10,000 to 1 range — high output on all ranges — band switching for each range — vernier driven main calibrated dial with over 45 inches of calibration — vernier driven calibrated indicator marker tuning. Large grey crackle cabinet 16⅛" x 10⅝" x 7-3/16". Phase control for single trace adjustment. Uses three high frequency triodes plus 5Y3 rectifier — split stator tuning condensers for greater efficiency and accuracy at high frequencies — this Heathkit is complete and adequate for every alignment need and is supplied with every part — cabinet — calibrated panel — all coils and condensers wound, calibrated and adjusted. Tubes, transformer, test leads — every part with instruction manual for assembly and use. Actually three instruments in one — TV sweep generator — TV AM generator and TV marker indicator.

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Heathkit
TUBE CHECKER KIT

Features

1. Measures each element individually
2. Has gear driven roller chart
3. Has lever switching for speed
4. Complete range of filament voltages
5. Checks every tube element
6. Uses latest type lever switches
7. Uses beautiful shatterproof full view meter
8. Large size 11" x 14" x 4" complete
9. Checks new 9 pin piniatures

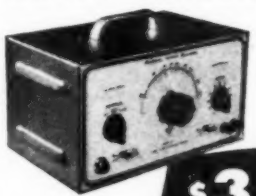
Only $29.50

Nothing ELSE TO BUY

Check the features and you will realize that this Heathkit has all the features you want. Speed — simplicity — beauty — protection against obsolescence. The most modern type of tester — measures each element — beautiful Bad-Good scale, high quality meter — the best of parts — rugged oversize 110V. 60 cycle power transformer — finest of Mallory switches — Centralab controls — quality wood cabinet — complete set of sockets for all type tubes including blank spare for future types — fast action gear driven roller chart uses brass gears to quickly locate and set up any type tube. Simplified switching cuts necessary time to minimum and saves valuable service time. Short and open element check. No matter what arrangement of tube elements, the Heathkit flexible switching arrangement easily handles it. Order your Heathkit Tube Checker today. See for yourself that Heath again saves you ⅔ and yet retains all the quality — this tube checker will pay for itself in a few weeks — better build it now.

Complete with detail instructions — all parts — cabinet — roller chart — ready to wire up and operate. Shipping Wt., 15 lbs.

Heathkit
SINE AND SQUARE WAVE AUDIO GENERATOR KIT



Nothing ELSE TO BUY

$34.50

Experimenters and servicemen working with a square wave for the first time invariably wonder why it was not introduced before. The characteristics of an amplifier can be determined in seconds compared to several hours of tedious plotting using older methods. Stage by stage, amplifier testing is as easy as signal tracing. The low distortion (less than 1%) and linear output (± one db.) make this Heathkit equal or superior to factory built equipment selling for three or four times its price. The circuit is the popular RC tuning circuit using a four gang variable condenser. Three ranges 20-200, 200-2,000, 2,000-20,000 cycles are provided by selector switch. Either sine or square waves instantly available at slide switch. All components are of highest quality, cased 110V. 60 cycle power transformer. Mallory F.P. filter condensers, 5 tubes, calibrated 2 color panel, grey crackle aluminum cabinet. The detailed instructions make assembly an interesting and instructive few hours. Shipping Wt., 13 lbs.

New Heathkit
BATTERY ELIMINATOR KIT

Nothing ELSE TO BUY

$22.50

Now a bench 6 Volt power supply kit for all auto radio testing. Supplies 5 - 7½ Volts at 10 Amperes continuous or 15 Amperes intermittent. A well filtered rugged power supply uses heavy duty selenium rectifier, choke input filter with 4,000 MFD of electrolytic filter. 0 - 15 Volt meter indicates output. Output variable in eight steps. Excellent for demonstrating auto radios. Ideal for servicing — can be lowered to find sticky vibrators or stepped up to equivalent of generator overload — easily constructed in less than two hours. Complete in every respect. Shipping Wt., 18 lbs.

NEW *Heathkit*
SIGNAL TRACER AND UNIVERSAL TEST SPEAKER KIT

Nothing ELSE TO BUY

$19.50

The popular Heathkit signal tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker —locates intermittents—defective parts quicker—saves valuable service time—gives greater income per service hour. Works equally well on broadcast — FM or TV receivers. The test speaker has assortment of switching ranges to match push pull or single output impedance. Also test microphones, pickups — PA systems — comes complete — cabinet — 110V. 60 cycle power transformer — tubes, test probe, all parts and detailed instructions for assembly and use. Shipping Wt., 8 lbs.

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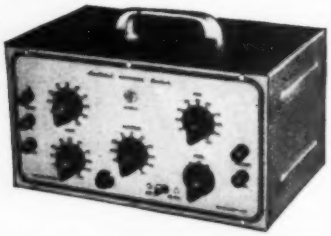
Heathkit
ELECTRONIC SWITCH KIT

DOUBLES THE UTILITY OF ANY SCOPE

$34.50



Nothing ELSE TO BUY

An electronic switch used with any oscilloscope provides two separately controllable traces on the screen. Each trace is controlled independently and the position of the traces may be varied. The input and output traces of an amplifier may be observed one beside the other or one directly over the other illustrating perfectly any change occurring in the amplifier. Distortion — phase shift and other defects show up instantly, 110V. 60 cycle transformer operated. Uses 5 tubes (1 6X5, 2 6SN7's, 2 6SJ7's). Has individual gain controls, positioning control and coarse and fine sweeping rate controls. The cabinet and panel match all other Heathkits. Every part supplied including detailed instructions for assembly and use. Shipping Wt., 11 lbs.

Heathkit
3-TUBE ALL WAVE RADIO KIT

$8.75

CABINET EXTRA

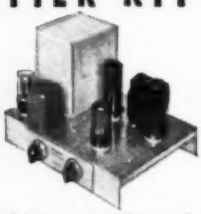
An ideal way to learn radio. This kit is complete ready to assemble, with tubes and all other parts. Operates from 110V AC. Simple, clear detailed instructions make this a good radio training course. Covers regular broadcasts and short wave bands. Plug-in coils. Regenerative circuit. Operates loud speaker. Shipping Wt., 3 lbs.

HS30 Headphones per set	**$1.00**
2½" Permanent Magnet Loudspeaker	**1.95**
Mahogany Cabinet	**2.95**

Heathkit
HIGH FIDELITY AMPLIFIER KIT

Nothing ELSE TO BUY

$14.95

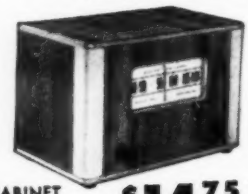


Build this high fidelity amplifier and save two-thirds of the cost. 110V. 60 cy. transformer operated. Push pull output using 1619 tubes (military type 6L6's), two amplifier stages using a dual triode (6SL7), as a phase inverter give this amplifier a linear reproduction equal to amplifiers selling for ten times this price. Every part supplied; punched and formed chassis, transformers (including quality output to 3-8 ohm voice coil), tubes, controls, and complete instructions. Add postage for 20 lbs.

12" PM Speakers for above....$6.95

Mahogany Speaker Cabinet, 14½" x 14½" x 8".....$8.75

New Heathkit
FM TUNER KIT



CABINET EXTRA

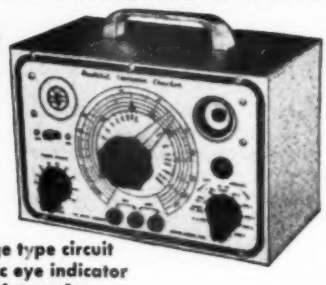
$14.75

A truly fine FM Tuner with the coils ready wound, all alignment completed — all that is necessary is wiring and it's ready to play — uses super regenerative circuit — 110V. 60 cycle transformer operated — two gang tuning condenser — slide rule calibrated dial — two tubes — complete instructions including pictorial enable even beginners to build successfully. Shipping Wt., 4 lbs.

Beautiful mahogany cabinet for FM Tuner (shown above) extra $3.75

Heathkit
CONDENSER CHECKER KIT

$19.50



Features

- **Power factor scale**
- **Measures resistance**
- **Measures leakage**
- **Checks paper-mica-electrolytics**
- **Bridge type circuit**
- **Magic eye indicator**
- **110 V. transformer operated**
- **All scales on panel**

Checks all types of condensers, paper-mica-electrolytic-ceramic over a range of .00001 MFD to 1000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage for 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110V. 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instructions for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill. Shipping Wt., 7 lbs.

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PE101C BC645 POWER SUPPLY

NO. 273. Complete power supply for BC 645. Operates from 12 or 24 Volts. Supplies both AC and DC required. Shipping Wgt. 13 lbs. Each **$3.95**

DM 35 12 VOLT DYNAMOTOR

NO. 274. New input 12 Volt at 18.7 Amperes. Supplies 675V at 275 MA or ½ above voltage from 6 volts. Excellent for auto use. Shipping Wgt. 11 lbs. Each **$7.50**

HOME WORKSHOP GRINDER KIT

NO. 230. Easily assembled 110V AC or DC ball bearing fully enclosed motor from Army surplus dynamotor. Purchaser to make simple changes and shaft extensions, detailed instructions and all parts supplied. Motor approximately 5,000 R.P.M. Ideal for tool-post grinder, flexible shaft tool, model drill press, saw. Shipping Weight 6 lbs. **$3.95**

COLLINS AUTOTUNE CONTROL HEAD

NO. 278. Brand new controls used on the ART/13, 100 Watt, Transmitter. Types 7, 8, 10, and 11 available. Get a spare while available as new cost is over $22.00 each. Shipping Wgt. 3 lbs. Price any type (mention when ordering). Each **$4.50**

300 MA SELENIUM RECTIFIERS

NO. 209. Rated 300 MA at 36 Volts, complete with mounting brackets. Shipping Wgt. 1 lb. 3 FOR $1.00

1N90 FEED THROUGH INSULATOR

NO. 276. Heavy duty feed through, 2" diameter 4" long, complete with brass hardware and gasket. Shipping Wgt. 2 lbs. 2 FOR **$1.00**

1N86 STRAIN INSULATOR

NO. 277. Husky army type 1¼" diameter, 5¼" long. Brown porcelain. Shipping Wgt. 4 lbs. 4 FOR **$1.00**

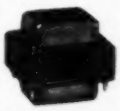
G.E. BC 306 ANTENNA TUNING UNIT

NO. 231. Matches any aerial to 150 Watt transmitter, used on BC 375. Brand new. Add postage for 20 lbs. **$2.95**

G. E. 1,800 VOLT 350 MA DYNAMOTOR

NO. 213. An ideal dynamotor for mobile operation in taxicabs, police cars, sound systems and amateur stations. Supplies above voltage from 12 Volts or 500V. at 350 MA from 6 Volts. Complete with starting relay, and fuses. New. Our Dynamotor A. Shipping Weight 72 lbs. **$5.95**

POWER TRANSFORMER *Specials*



NO. 226. Primary 117V. 60 cycle. Secondaries supply 746 V.CT at 220 MA, 6.3V. at 4.5 A., and 5V. at 4A. Will handle 13 tube radio receivers. Supply is limited, order early. Shipping Weight 11 lbs. each. **$3.95 . . 3 for $9.95**

T32 TABLE MICROPHONE

NO. 210. One of the Army's best. Built by Kellogg, ideal for factory call system, public address, amateur use. Brand new in original cartons. Add postage for 5 lbs. **$2.95**

MINIATURE ELECTRIC MOTOR

NO. 211. Tiny Delco motor only 1" x 1¼"x2" 10,000 RPM. Operates from 6 to 24 V. Excellent for models. Add postage for 1 lb. **$2.95**

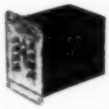
OUTPUT TRANSFORMER

NO. 227. Push pull 6V6's to 6 - 8 ohm voice coil excellent characteristics, 3 for $1.95

RCA SATURABLE REACTOR TRANSFORMER

NO. 246. New RCA No. CKV30531 AC current 750 MA DC current 2 Amperes. Rated 1.75 henries. Shipping wgt. 4 lbs. Each **$1.00**

12.6V POWER TRANSFORMER



NO. 247. New cased 110 V 60 cy. Power Transformer. Supplies 440V Ct. at 60 MA, 6.3V at 2A. and 12.6V at 1 Amp. Excellent for military sets. Shipping Wght. 6 lbs. Each. **$1.95**

RCA INPUT TRANSFORMER

NO. 248. Heavy duty RCA No CKV-30529. Input has primaries 600 to 200 and 25 ohms secondary 250,000 ohms C.T. Shipping Wgt. 2 lbs. Each **$1.00**

FEDERAL POWER TRANSFORMER

NO. 252. New cased 110V 60 cy. Power Transformer. Supplies 480V CT at 50 MA and 6.3 V at 2.1 Amps. A beautiful transformer. Shipping Wgt. 4 lbs. Each **$1.50**

MILITARY POWER TRANSFORMERS

NO. 229. Convert your military receivers without rewiring the filament. "A" type supplies 500 VCT at 50 MA, 5V. at 2A. and 24V. at ½ A. "B" type supplies 500 VCT at 50 MA, 5V. at 2A. and 12V. at 1 Amp. State whether A or B type desired. Shipping Weight 4 lbs. **$2.95**

WALKIE TALKIE TRANSFORMER

No. 744. Carbon microphone input transformer and output to headphone transformer, all in one case, excellent for building your own. Shipping Wt. 1 lb. 4 for $1.00

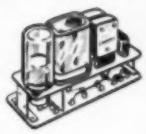
LOW PASS FILTER UNIT

No. 637. 3000 cycle cutoff consists of 3 inductances and 4 capacitors in network, 500 ohms in and out. Excellent for clipping all frequencies above 3000 cycles. Drawn steel case, shipping Wt. 5 lbs. $2.50

FM PUSH BUTTON TUNER

NO. 224. Brand new ten push button tuning assembly from Army FM receiver. Contains 4 gang 100 MMF silver plated tuning condenser. Add postage for 10 lbs. **$2.50** EACH

BC 746 TUNING UNIT



NO. 257. Plug in transmitter tuning unit from army Walkie Talkie. Contains antenna and tank coils, tuning condenser, transmitting and receiving crystals. Ideal transmitter foundation. Shipping Wgt. 1 lb. Each **$1.00**
(Same as above except transmitter crystal in 80 meter amateur band $2.50 each)

T30 THROAT MICROPHONE

NO. 258. Makes excellent contact microphone for musical instrument or vibration pick-up. Shipping Wgt. 1 lb. $1.00 each
Extension cord with switch for above $ .50 each

BC731 CONTROL BOX with Weston Model 476 AC Voltmeter

NO. 208. Excellent buy in meter control box. Size 8"x10"x5½". Contains Weston 0-150V. AC 3½" voltmeter, meter starting switch, 28 fuses all 30 Amp 110V. and 8 fuse holders. Fuses and holders alone worth the price. Shipping Weight 18 lbs. **$7.95**

METER SPECIAL

NO. 237. Brand new DeJur Model 312 0-800 M.A. D.C. Square 3" 0-10 M.A. basic meter with built in shunt. Probably the best buy ever offered in a surplus meter. Shipping Weight 1 lb. **$2.95**

HEARING AID HEADPHONES

NO. 216. The Army's best — eliminate flat ears and outside noise. Complete with transformer for conversion from low to high impedance. With cord and plug complete.
Add postage for 1 lb. **$1.00**

BC 451 CONTROL BOX

NO. 236. Control box for 274N transmitters. Contains proper cw-voice switch, 4 channel switch, power switch, mike jack and telegraph key.
Add postage for 2 lbs. $1.95

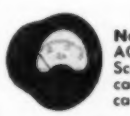
100 MA FILTER CHOKE

No. 641. Heavy 1.5 henry choke in drawn steel case, 50 ohm resistance, conservatively rated at 100 MA. Shipping Wt. 1 lb. 50c

FILAMENT TRANSFORMER

No. 922. 220V. 60 cy. primary supplies 12.6V. at 3.5 Amps, 15.6V at 1 Amp. Supplies 6.3 at 3.5 Amps and 7.8V. at 1. Amp from 110V. Shipping Wt. 8 lbs. $1.50

PANEL METER



Burlington 0-300 VAC Meter
No. 290. Model 32XA 3½" round AC Voltmeter 0-300 VAC full scale. Scale also calibrated 0-600V. Bakelite case. A beautiful meter in original carton. Shipping Wt. $3.95

DRIVER TRANSFORMER

No. 651. Couples 3000 ohm plate to push pull parallel grids hermetically sealed. Ship. Wt. 1 lb. $1.00

OUTPUT and MODULATION TRANSFORMER

No. 745. Companion transformer to above driver. A push pull output, 3000 ohms to 3.2 ohm voice coil, or to 1250 ohms at 80 MA. A high quality cased unit. Shipping Wt. 2 pounds. $1.00

HOW TO ORDER • • • GIVE PART NUMBER AND DESCRIPTION . . . ADD POSTAGE FOR WEIGHT SHOWN. NO ORDERS UNDER $2.00 . . . WE WILL SHIP C.O.D.

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What's New in Radio

PORTABLE POWER SUPPLY

A fifty-pound unit that provides well-regulated d.c. power at loads from 200 to 300 milliamperes with an ad-

justable output of between 260 and 290 volts has been announced by the *RCA Victor Division* of *RCA*, Camden, New Jersey. Power requirement is 120 v., 60 cycles, at 300 w.

Controls consist of an a.c. line voltmeter, an "On-Off" switch, meter selector switch, output voltage adjustment, and meter jack. The transformer, tubes, and filter condensers project from the front of the chassis, while the resistors and plug connectors are at the rear.

This Model TY-25A is suitable for laboratory, broadcast, and other communications where d.c. is required. Although it actually was designed as a portable unit, it may be mounted in an *RCA* cabinet or open racks, being the standard width.

REDY-PLAY PHONOGRAPH

Recently introduced into the low-price phonograph field by the *Glenwood Company* of East Orange, New Jersey, is the Redy-Play for children, available in four colors: blue, yellow, pink, or white.

One of the most original features of this unit is the automatic shut-off switch that operates the turntable and amplifier simultaneously, turning them on when the tone arm is placed on the record, and off when it is replaced on the pickup rest, making it

impossible to leave the phonograph running when it is not being used. There is no necessity for amplifier warmup because of a special circuit that enables the device to play instantly at full power.

Sturdy, compact construction; full range; high-gain volume control; and a lightweight *Astatic* pickup are other desirable features of the phonograph, which is manufactured by *Crystal Devices*.

RCA 15-INCH SPEAKER

Stressing the combined features of low cost and high-quality reproduction in its announcement, the *RCA* Tube Department, Camden, New Jersey, recently introduced the *RCA*-515S1 loudspeaker, a duo-cone, permanent-magnet type.

This new unit handles 25 watts input and possesses high sensitivity between 40 c.p.s. and 12,000 c.p.s. Each section of the dual cone is driven by its own voice coil operating in its own air gap, both of which are excited by a single, two-pound Alnico V magnet. So that sound pressure from each emanates

from approximately the same conical surface, the two-cone-sections are mounted in a single housing.

Designed for initial equipment or replacement use in radio and TV receivers, broadcasting-station monitors, the 515S1 may be used for rim mounting in accordance with RMA standards and as direct replacement for existing 15-inch rim-mounted speakers.

ALNICO MATERIALS

Two new magnetic materials of the type used in radio loudspeaker manufacture and in other communications equipment have been developed by the *General Electric Company* of Pittsfield, Mass.

One of these, a modification of Alnico 5, is the product of a change in the manufacturing process that makes possible an alignment of the crystal structure in the direction of magnetization. Alnico 5 DG, the letters DG standing for directional grain, permits the utilization of smaller magnets for the same work performed by larger units.

Also developed for maximum coercive force is the *G-E* Alnico 7, for applications where a high demagnetization force is present, such as in generators, motors, etc.

Manufacturers of radio speakers, magnetic separators, and other instruments needing high external energy and residual induction will find in the utilization of these improved *G-E* magnetic materials the advantage of a reduced manufacturing cost made possible by the smaller size magnets which will be required.

TALK-A-PHONE INTERCOM

An extensive intercommunication system, called the "Chief Forty-Niner," has been announced by the *Talk-A-Phone Co.*, 1512 South Pulaski Road, Chicago 23, Ill., by which it is possible to carry on a conference meeting, or to talk privately with one person.

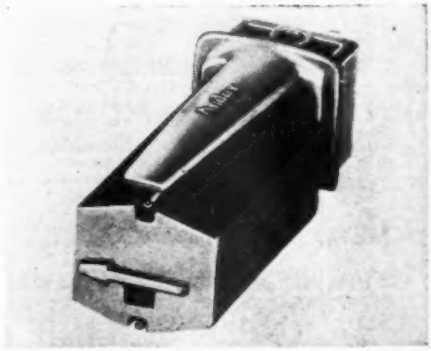
The units operate on 110-120 volts a.c. or 110 volts d.c., at 25, 40, 50, or 60 cycles, and as optional equipment, the company provides earphones for privacy and a booster for high-power paging.

Every possible application has been foreseen in the design, and all master stations, master and staff, or a number of master stations intermixed with staff units may be utilized in setting up a system. It is possible to include in one master station as much as thirty-station selectivity, with but twelve push-buttons; units may be set up as far apart as 3000 feet. Extensive, illustrated instructions are provided with the units to insure the best possible service.

AUDAK REPRODUCER

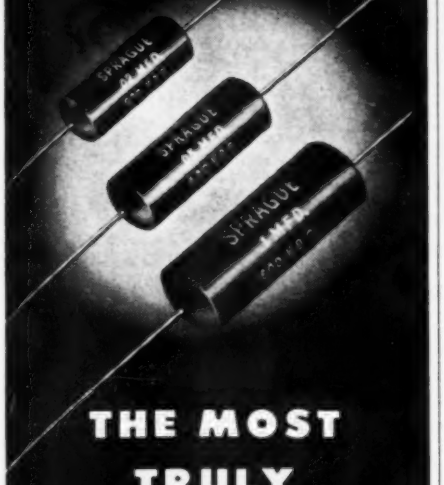
A magnetic unit that will play all of the diverse disc types available today is being introduced by the *Audak Company*, 500 Fifth Ave., New York 18, N. Y. One unit is sufficient to take care of every type of record, with no shifting of apparatus.

Ten different combinations of styli



are possible when using the "Polyphase," and the device is easy to mount on almost any type of tone arm, producing wide-range performance and utilizing an output of about 30 millivolts. Other features of this compara-

SPRAGUE
PHENOLIC-MOLDED
TELECAP*
TUBULARS



THE MOST TRULY DEPENDABLE PAPER TUBULAR CAPACITORS EVER OFFERED TO THE SERVICE PROFESSION

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- High Insulation Resistance
- High Dielectric Strength
- Unequalled for Sizzling AC-DC Midgets, or "Hot" TV and Auto Sets.

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North Adams, Mass.
*Trademark

tively low-priced reproducer are high or low impedance, low needle radiation, and the achievement of an excellent tone quality.

PLUG-IN AMPLIFIER UNIT

One of the smallest plug-in amplifiers ever designed has been produced by a hearing-aid manufacturer, the *Microtone Company,* and is called the "Sound Screen."

Wires, soldered connections, and the maze of parts usually incorporated in

such units are eliminated, and the whole is sealed in solid plastic to keep it moisture, dust, shock, and tamperproof. Pattern for the design was the plug-in type of component used by the Armed Forces. Further details may be had by writing the company at Ford Parkway, St. Paul 5, Minn.

BRUNING "EQUIPOISE" DRAFTERS

Combining the functions of the T-square, straightedge, triangle, protractor, and scale into a single unit, the new drafting machines recently introduced by the *Charles Bruning Company, Inc.,* 4754 Montrose Ave., Chicago 41, Ill., feature the "Equipoise" mechanism.

This device counteracts the effect of gravity on a tilted drawing board; the drafter can glide into any desired posi-

tion and hold it. Other features are a base line clamp for greater convenience in aligning the drafter to the drawing, ball joints on both arms for flexibility, and increased space between the double thumb screws that improve anchorage.

Turning the fluted adjustment knob on the "Equipoise" mechanism sets the correct tension for all board angles between 0 and 20 degrees from the horizontal, and the touch control button allows the drafter head to be ro-

(*Continued on page* 120)

SPRAGUE DISC

CERAMIC BYPASS AND COUPLING CAPACITORS

These new ceramic units—no bigger than a dime—find dozens of bypass and coupling uses in both standard and FM as well as television equipment. They have higher self-resonant frequencies than conventional capacitors and fit neatly across miniature tube sockets. They're covered with a tough, protective coating which guards against moisture and heat. Sprague Disc ceramics are available in both single and money-saving dual capacitors.

Use Sprague Disc ceramics whenever circuits call for ultra-compact, bypass or coupling capacitors. Each unit is clearly stamped with capacitance. All capacitors are rated at 1000 v. test, 500 w.v.d.c.

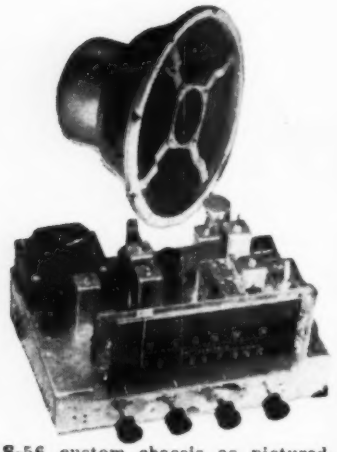
See these remarkable new capacitors at your Sprague distributor today! *Write for bulletin M 431.*

SPRAGUE
PRODUCTS COMPANY
Distributors' Division
of the Sprague Electric Company
NORTH ADAMS, MASS.

hallicrafters

S-56 11 TUBE FM-AM CUSTOM CHASSIS A REGULAR $110.00 VALUE AT McGEE FOR $59.95

★ RECEIVES FM 88 TO 108 MC. AND BROADCAST 550 TO 1700 KC.
★ PUSH PULL 6K6, RESPONSE 40 TO 14000 CPS ★ PHONO INPUT
★ PRE-SELECTION ON AM ★ NEW 1949 PRODUCTION ★ GUARANTEED



S-56 custom chassis as pictured, with 12" coaxial speaker **$69.95.** Less speaker **$59.95.**

S-56 Hallicrafter custom chassis with tubes and operating instructions and 12" Model CR-13X coaxial PM, $32.50 list speaker, ready to play; as pictured above. Shipping weight 33 lbs. Net **$69.95.**

Dual purpose preamplifier now available at $3.95

Model S-56 Hallicrafters, 11 tube AM-FM radio receiver chassis for broadcast and FM 88 to 108 mc. Automatic frequency control on FM, holds the receiver in perfect tune. Phono connection on rear of chassis. Full range tone control with bass boost. Push-pull 6K6 tubes in audio system. Frequency response essentially flat, from 50 to 14,000 CPS. Wide vision accurately calibrated slide rule dial, with preselection on broadcast band. Output transformer matches any 8 ohm PM speaker. 4 antenna terminals, two for AM and two for FM. This is the finest type home radio that we know of today. Better get your order in early. Designed to be used in commercial radio selling in the $400.00 to $600.00 class. The regular dealers net on this chassis is $110.00. However, a lucky purchase enables us to offer these brand new, factory cartoned S-56 Hallicrafters chassis, complete with tubes and operating instructions, at only $59.95 less speaker. Chassis size 12¾ x 10 x 7¾". Weight 22 lbs. Brand new factory cartoned. Buy your S-56's with a wide range PM speaker. Pick your combination from the prices listed below and save.

S-56 Hallicrafter custom chassis with tubes and operating instructions and super 12" 21 oz. Alnico V PM speaker, ready to play. Shipping weight 38 lbs. Net **$69.95.**

S-56 Hallicrafter custom chassis with tubes and operating instructions and 15" 21 oz. Alnico V PM, ready to play. Shipping weight 45 lbs. Net **$73.95.**

Dual purpose preamplifier for S-56. Only 4 wires to connect (instructions furnished). Input jacks for General Electric variable reluctance pickup and crystal or dynamic mike. This makes your S-56 a home P.A. system. Shipping weight 2 lbs. Size 3½ x 4 x 3". Stock No. AP-1. Net **$3.95.**

Shure 708A, regular $22.00 list crystal mike with cord, **$8.95** extra. Adjustable banquet type desk stand **$2.95** extra.

McGEE OFFERS COMPLETE FACTORY ENGINEERED RADIO AND AMP KITS

GAROD PERSONAL PORTABLE KIT $11.95 with Batteries KIT MODEL X-45 $12.95

Complete Garod Personal Portable Radio Kit Model X-45. Made from genuine Garod factory matched parts. A complete kit to build a broadcast battery operated 4 tube receiver. Small in size 6½x3¼x4½". Weight 3½ lbs. 2 Gang Superhet circuit set comes on when lid opens. Rugged metal case with colored plastic front and back. Loop antenna in lid. Furnished with diagram and photos, tubes and 6 x ½ B-Battery. Will go together like a factory built radio. Shipping weight 6 lbs. #X-45 **$11.95.** Model X-45WT Portable Radio in X-45 wired ready to operate net **$14.95.**

GAROD DELUXE 5-Tube Kit $9.95

This is our latest and finest AC-DC radio kit. Receives Broadcast, 540 to 1650 KC. Has full length illuminated slide rule dial. Choice of Ivory or Walnut plastic cabinet. Full high efficiency 2 gang superhet circuit, with loop antenna. Ready punched chassis, full 5" PM speaker. Every part fits. Everything furnished, including tubes, 12SA7, 12SK7, 12SQ7, 35Z5 and 50L6. This kit will go together just like it would on the production line. Diagram, photos and instructions are furnished. Shipping weight 9 lbs. Kit model XA-49. Net **$9.95.**

ONLY $9.95 BUYS A 6-TUBE RADIO KIT

6 tube superhet, broadest AC-DC kit. Using full size tubes. House in a Farnsworth plastic cabinet, with slide rule dial. R.F. stage, 2 gang condenser, loop antenna and 5" speaker. This makes a factory like radio. The cadmium chassis is ready punched and sockets are installed. This type of kit usually sells for at least $15.00. All parts furnished, including tubes: 12K8, 2—12SK7, 12SR7, 35L6 and 35Z5. Complete with diagrams and photos. Kit model FS-6. Wt. 8 lbs. **$9.95.**

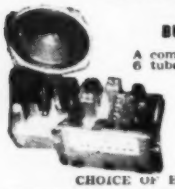
New 3-Way PORTABLE RADIO KIT ONLY $9.95

Sensational new 3-way portable radio kit. 4 tubes plus rectifier. Housed in an all aluminum, leatherette covered case made by Farnsworth, with loop antenna built-in. Size 5x9 x6". Build yourself a professional looking radio with this kit. Every piece furnished including tubes: 1R5, 1T4, 1S5, and 3V4, as well as easy-to-follow diagram and photo. This set will make a full two gang superhet, that looks like a $40.00 radio. We should ask $17.00 for this kit. Stock No. FP-4X, complete kit less batteries, weight 8 lbs. Net price **$9.95.** Kit of batteries, 67½ volt "B" and "A", **$2.25** extra.

6-TUBE AC 2 BAND RADIO KIT $9.95

BIGGEST RADIO KIT VALUE IN U. S.

BUILD A RADIO WITH MATCHED "DETROLA" PARTS



A complete kit of parts, tubes and ready punched chassis to build a fine 6 tube power transformer type radio chassis. (No cabinet.) We furnish every piece as well as a printed diagram and photograph. Chassis size 14 x 7½ x 7. Receives standard broadcast and 6 to 18 MC foreign short wave. 3 gang tuning condenser used on both bands. 90 mil power transformer 6v6 output tube. This kit is made up of parts intended for use in a high quality Detrola radio. Has full lighted slide rule dial. Everything goes together just like a factory built radio. Priced complete with 6 tubes. Kit model 6-ACX. Less speaker. Weight 16 lbs. Net **$9.95.**

CHOICE OF EITHER 8 OR 10 INCH DYNAMIC SPEAKER $1.99 EXTRA

MCGEE'S NEW FM-AM-PA KIT $39.95

12 Tube Kit Model PRK-51. This is the most elaborate radio, P.A. kit that our engineering department could design. Here are its features: Receives broadcast, 550 to 1650 kc and FM, 88 to 108 mc (3 gang tuning on FM.) The audio system is wide range, 40 to 17,000 cps., 5 lb. interwound high fidelity output matches 8 ohm speaker. Twin tone controls, (base and treble boost). Phonograph inputs for standard crystal or General Electric variable reluctance. Mike input for crystal or dynamic mike. This radio may be used for an 18 watt P.A. system, a recording amplifier, or for a high fidelity T.V. sound system. Chassis size, 15½ x 7½ x 7½". ready punched. Everything furnished with the kit, including tubes: 6AG5, 6SB7Y, 2—8BA6, 6AT6, 6H6, 6BE6, 2—12AT7, 2—6V6 and 5Y3. The FM RF section is ready wired (coils and sockets), to make this kit easier for you to build. 6" slide-rule dial. Complete kit model PRK-51, with photos and instructions, **$39.95.** Speaker recommended. Oxford 12", 22 oz. PM, curved cone and 1½" voice coil. Model 12-XMS **$10.00** extra.

PORTABLE RECORD PLAYER KIT $9.95

Deluxe Portable Record Player Kit housed in the attractive Capitol case. Includes all parts and easy to follow diagram. Has 4" Heavy Duty PM Speaker, 78 RPM Phono Motor. All necessary parts to build a 70L7 type Amplifier. Weight 14 lbs. Model CK-1. Net **$9.95.**

3-SPEED PLAYER KIT $16.95

3 Speed Record Player Kit. Deluxe Capital portable case pictured above. All parts furnished to build a two tube 70L7 type amplifier (Tone and Volume Control). Alnico V PM Speaker. 33, 78 and 45 RPM. Phono Motor. Easy to follow assembly instructions. Shipping weight 16 lbs. Stock No. 347-K. Net **$16.95.**

12-WATT AMP KIT FOR INSTRUMENTS MIKES OR PICKUP $14.95

General purpose portable amplifier kit, housed in an attractive portable case, with 10" speaker. Two inputs for instruments or mike, one phono input. Variable tone control. Kit is complete with diagrams and photos and tubes: 2—12AX7, 6X4, 2—6AQ5. AC transformer type. Stock No. MM-18RC, weight 20 lbs. Net **$14.95.**

Crystal mike and desk stand, **$4.95** extra.

Stock No. RM-4 Phono motor with weighted top for recording. Net **$5.95.** Best quality 78 RPM phono motor with 9" turntable. Net **$2.95.**

3-speed phono motor, 33⅓, 78 and 45. While our limited stock lasts. Net **$5.49** ea.

1 HOUR TAPE RECORDER MECHANISM $59.95

TAPE RECORDER 1 HOUR MECHANISM TWIN CHANNELS SPECIAL $59.95

Our leader tape recorder mechanism—Size 10½ x 13⅝ x 7-5/16, weight 16 lbs. Tape speed full 7½ feet per second—two tracts. One hour with 7" reel, 30 minutes with 5" reel. Bias frequency to erase 50K.C. Twin erase heads, one recording head. Response flat from 60 to 8,000 cps. Non-slip and Wow-less drive. Made for high fidelity recording and play-back on tape. Furnished complete with suggested diagram and erase coil. Model TP4-X Tape recorder mechanism, sale price, **$59.95.** Recording Tape 7" Reel. **$2.70.**

AMPLIFIER KIT FOR TAPE RECORDING $17.95

Tape recorder, playback amplifier Kit Model TPR-10. All parts, punched chassis pan, tubes, photos and diagram furnished. When wired will make a tape recorder and playback amplifier of good quality. Inputs for crystal or dynamic mike and phono pick-up. (May be connected to the detector of any radio set to record radio programs.) Output transformer matches any 8" speaker. Volume control. Complete with tubes: 6SF5, 7F7, 7N7, 2—6V6, and 6X5. Shipping weight 20 lbs. Stock No. TPR-10. Net **$19.95.**

COMPLETE PORTABLE TAPE RECORDER KIT $79.95

Complete portable magnetic tape recorder kit. Factory engineered. Everything furnished. Attractive leatherette case, 6x9" heavy duty speaker. One hour capacity tape recorder and playback mechanism. Records and plays back in both directions, with lever selector switch. Amplifier kit is an AC transformer type, with punched chassis and all parts furnished. Includes tubes and diagram. Inputs for crystal mike and phono pickup or radio input. External speaker jack. Shipping weight 45 lbs. Stock No. SS-4. Net **$79.95.** Crystal recording mike **$4.95** extra. Plastic coated kraft base recording tape, 5" 600 foot reel ¼" wide (30 min. on twin track, 15 min. on single track) No. 105. Net **$1.65** each.

7" reel, 1200 feet ¼" wide. One hour on twin track, 30 min. on single track. No. 107. Net **$2.70** each.

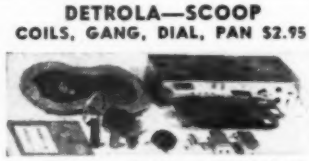
ST. GEORGE WIRE RECORDER MECHANISM $22.95

St. George wire recorder mechanisms. Brand new, complete wire recording and playback mechanism. (Also plays 78 RPM records when crystal pick-up is installed.) Records and plays back up to 1 hour on standard Webster wire. Furnished with diagram for 3-tube converter (adapts radio or amplifier for wire recordings). X-93 St. George mechanism, weight 15 lbs. Requires 6x13x3½" space. Net, **$22.95.** Crystal pick-up for playing and recording phono records. **$3.95** extra. Webster wire, 1 hour, **$3.25**; 30 min., **$1.95**; 15 min., **$1.30.** Crystal mike and desk stand, **$4.95** extra.

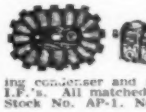
WIRE RECORDER CONVERTER $12.95. With this 3-tube converter you can adapt the St. George Airking, or Webster Chicago wire recorder mechanism to any radio or P. A. system. Only 3 connections necessary. Just plug in to the phono input of your amplifier and connect to plate of output tube. AC-Tranformer construction, gain for mike, 3 position switch for quickly changing from record to play-back. Priced ready wired and tested with instructions and tube 12AT7 preamplifier; 6AQ5 Oscillator erase; 6X4 rectifier. Stock No. RR-Y. net, **$12.95.**

St. George wire recorder mechanism. Same as described above, only classed as repairable. Any good technician can repair these. Stock No. SG-J4. Net price **$12.95.**

DETROLA—SCOOP COILS, GANG, DIAL, PAN $2.95



Genuine Detrola Chassis pan with 6 octal sockets. Heavy glass slide rule dial. 3 Gang Tuning condenser. All RF and IF coils and band switch for standard broadcast and foreign short wave. Buy these parts for less than the coil value alone. These parts all fit the chassis properly. Only material pictured and listed above is offered. It is not a complete kit. You supply your own tubes, speaker, resistors, condensers, etc. Stock No. DET-1. Shipping weight 9 lbs. Net **$2.95.**



$1.39

You get a broadcast loop, osc. coil, 2 gang tuning condenser and matched pair of 456 kc I.F.'s. All matched. The heart of a radio. Stock No. AP-1. Net **$1.39.**

Build Your Own Radio Station

Miniature Broadcast Station Kit $6.95

Kit Model DE-6X. Build your own 110 Volt AC-DC 4 tube miniature radio station-on-800 to 1500 KC) broadcast from crystal mike or phono record. (Warning: this transmitter must be used with only a short aerial otherwise you will transmit 2 or 3 miles.) Complete kit including tubes, diagram and instructions. Weight 4 lbs., net **$6.95.**

Model DE-6XWT. Miniature transmitter ready to operate **$8.95.** Crystal mike and desk stand **$4.95** extra.

McGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with Order, Balance C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI

hallicrafters

S-59 8-TUBE CUSTOM FM-AM CHASSIS

McGEE BUYS SOLID CARLOAD TO OFFER THESE FOR $32.95

★ PUSH-PULL 6K6 WIDE RANGE AUDIO ★ PHONO INPUT

★ LATEST 1949 PRODUCTION ★ WHY BUY ANYTHING BUT A HALLICRAFTER'S

Model S-59 Hallicrafters, high fidelity, 8 tube FM/AM chassis, for custom installations. Receives broadcast 540 to 1700 kc and FM 88 to 108 mc. Size 12½x7½x9". An excellently engineered chassis, with accurately calibrated slide rule dial. Variable tone control and 60 to 14,000 CPS wide range audio. (Push-pull 6K6's) 8 ohm output transformer will match most speakers. No special output transformer required. Loop antenna built on for broadcast reception. Includes tubes: 2—6BA6, 6BE6, 6AL5, 6SQ7, 2—6K6 and 5Y3. This is without a doubt the most radio chassis we have ever been able to offer. Better rush your order now. We have them.

S-59. 8 tube FM/AM chassis, with tubes. Weight 16 lbs. Net **$32.95.**

S-59. 8 tube FM/AM chassis, with tubes and regular **$12.95.** 12" coaxial PM speaker, CR-13X. Weight 24 lbs. Net **$42.95.**

Hallicrafters S-59, as pictured with 12" lenoviagraph coaxial RM speaker..$42.95
S-59 less speaker..... 32.95

SERVICEMEN! SAVE ON PARTS AT McGEE

SOLAR METAL F.P. CONDENSERS

POPULAR TWIST MOUNTING IN ALUMINUM CANS

8 Mfd. 450 volt FP condenser	29c	25-25 Mfd. 25v FP	19c
16 Mfd. 450 volt FP condenser	34c	40 150v, 20 25v FP	15c
20 Mfd. 450 volt FP condenser	39c	40-40 Mfd. 150v FP	29c
30 Mfd. 450 volt FP condenser	39c	24-16 Mfd. 350v	39c
20 Mfd. 525 volt FP cond. Special	49c	20-10 350v 20 25v	39c
30 450v, 20 25v FP	39c	15-15 450v 20 25v	59c
40 250v, 20 25v FP	19c	40-40 Mfd. 450v	59c

Order **100** Assorted Solar Condensers and Take **10%** Discount from Above Prices.

ELECTROLYTICS UPRIGHT ALUMINUM CANS

These famous brand upright mounting, screw can aluminum electrolytics are marked by their catalogue number—Mallory.

RS-213	8 Mfd. 450V Aluminum Can	.34
RS-215	12 Mfd. 450V Aluminum Can	.39
RS-223	30 Mfd. 450V Aluminum Can	.39
RS-262	8X8 Mfd. 450V Aluminum Can	.39

Nat'l. Advertised BY PASS SALE

Bypasses, .03 400V., .3 400V., .006 600V., .04 600V., **8c** Each. **$6.95** for 100 Assorted.

1000 Volt, OK for Buffers, .002 1000V., .02 1600V., .04 1600V., .05 1600V., **10c** Each, 100 for **$7.95.**

McGee's ELECTROLYTIC SCOOP OF ALL TIMES

Popular Tubulars for Every Day Replacement

TCS50	50 Mfd. 150V	$0.24	ST595	8 Mfd. 450V	$0.29
TCS45	20X20 Mfd. 150V	.29	ST597	16 Mfd. 450V	.34
TCS47	30X30 Mfd. 150V	.34	ST598	20 Mfd. 450V	.39
TCS48	40X40 Mfd. 150V	.39	ST599	30 Mfd. 450V	.45
TCS52	10X10 Mfd. 250V	.25	2N-518	8x8 Mfd. 450V	.39
TCS55	20X20 Mfd. 250V	.29	38-579	8x8 Mfd. 450V, 20-25V	.39
TCS75	8X8 Mfd. 450V	.39	38-584	8x8x8 Mfd. 450V	.49
TCD55	20X20 Mfd. 250V	.29	48-718	8x8 Mfd. 450V, 10x10 Mfd. 25V	.49
TCD52	10X10 Mfd. 250V	.24	20 Mfd. 350V tubular Aerovox		.19
			40 Mfd. 350V tubular Aerovox		.29

Astatic Light Weight Pick Up. Less than one ounce pressure with 4V, L-82 Cartridge, **$2.29.**
Same as above only with 1 Volt, L-70 Cartridge, Net **$1.99.**
Webster light weight Arm (Stamped) with 4 Volt Cartridge. Net **$1.95.**
Webster Plastic Arm with 3 Volt Cartridge **$1.95.**
Micro Groove Arm with 1 Mill Needle **$3.95.**

G.E. RPX010 V.R. CART. $2.95

G.E. RPX010, with permanent needle, **$2.95** each; 10 for **$24.95.**

Kit of parts to build 6SC7 type preamplifier, **$2.49** extra.

A lucky purchase by us enables this terrific General Electric cartridge value.

WIRE RECORDER and 18-WATT P.A. SYSTEM

SALE PRICE **$69.95**

Three years of wire recording experience has led us to the development of this combination wire recorder and public address system. Housed in an attractive portable case with hinged lid on the recorder compartment. Beautiful streamlined plastic grill. Storage compartment in back panel for mike and accessories. Size 21x11x14. A full 18 watt HI FI amplifier with P.P. 6V6 tubes in output stage and separate 6AQ5 eraser circuit. This new super erase circuit eliminates all the bugs in wire recording. 12-inch Alnico V. P.M. speaker. Extension speaker jack. Mike input, tone control. Equipped with the St. George wire recorder playback mechanism that has 78 rpm turntable and General Electric Variable reluctance pick-up. You can record or play phono records. Record from mike. The play-back quality is tops. Plenty of volume and good fidelity. This is also a top wire recorder. Unit is completely assembled and ready to operate. Furnished with 15 minute spool of Webster recording wire. Extra recording wire, 15 min., **$1.30;** 30 min., **$1.95;** hour, **$3.25.** **Model GK-16** Portable public address system and wire recorder shipping weight 38 lbs. Net, **$69.95.**

Crystal Mike and Desk Stand, **$4.95** extra.

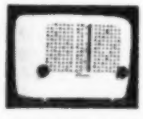
Webster N-7, same as L-40, L-70...**$1.19**
Astatic MLP-1, with needle 1.19
Astatic MLP-2, with needle 1.95
Astatic QT3-M, with needle..... 2.29
Astatic NJ-1, with needle 2.29
Astatic L-72 or Webster Equal 1.79
Astatic L-40 or Webster Equal 1.79
Astatic L-70 or Webster Equal 1.79
Take 10% off on 10-lot assortment.

MUSICAL P.A. 34-WATT $54.95

McGee's wide range musical P.A. amplifier, **$54.95.** Powerful 34 watt, wide range amplifier, housed in an attractive leatherette covered cabinet, with tri-color plastic front. 12" super heavy-duty Oxford curvelenier cone, 22 oz. Alnico V PM speaker. This speaker is used by others only on their highest priced amplifiers. Response from 40 to 17,000 cps. 3 inputs, 2 for musical instruments or mikes, one for crystal pick-up. Tone compensation for G.E. variable reluctance pick-up. Push-pull 6L6 output tubes, twin tone controls and inverse feedback. This amplifier may be used for two instruments or two mikes. It is the most versatile amplifier that we know of. Stock No. MM-35, complete ready to operate. Weight 26 lbs. Net price, **$54.95.**

$15.00 LIST ELECTRIC CLOCK $4.95

Elexa Self Starting Electric Clock, 6x5½x2¼". Gold finish with plastic front. Weight 4 lbs.
Stock # EX-1. Net.....**$4.95**

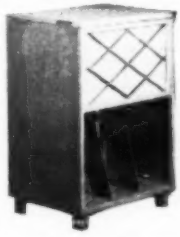


XMAS SPECIAL ARVIN 3-WAY $15.95

Arvin Model 241-P, 3-way pick-me-up portable radio. A full 4 tube plus rectifier superhet in a plastic case, with built-in loop antenna. Made to retail for **$29.95.** McGee scoop price only **$15.95.** Requires 4 flashlight cells and 67½ volt B battery, **$1.95** extra. Shipping weight 7 lbs. While our limited stock lasts, we offer you this red hot Christmas special.

100-600V. BY PASSES, $6.95 MAKE YOUR OWN ASSORTMENT

T .0001, T .00025, T .0005, T 001, T .002, T .005, T .006—**5c** Each.
T .02, T .03, T .04—**6c** Each.
T .05—**7c** Each; T .1—**8c** Each.
T .25—**10½c** Each; T .5—**15c** Each.



BLOND CONSOLE CAB. FOR S-59 $19.95

Beautiful blond console cabinet, 33" high, 17" front to back and 21" wide. The lower half is divided for record albums. A hinged lid covers the radio changer compartment. Changer space 12x15". Radio panel is ready cut for the Hallicrafter S-59. Use any speaker up to 6x9". Shipping weight 40 lbs. Stock No. JB-4 blond cabinet, ready cut for S-59, with uncut changer board. Net **$19.95.** 6x9" PM speaker **$2.95** extra. Stock No. JB-5X, above blond cabinet with blank radio panel (radio area 8x15", changer area 12x15"). Net **$19.95.** Stock No. B-1000, above blond cabinet, changer area 15x15", radio area 5x15". Build over to suit your needs as record player or combination. Net **$14.95.**

PRE-AMP FOR S-59 $3.95

The same dual purpose pre-amplifier offered with the S-56, also works equally well on the S-59—Stock No. AP-1. Net **$3.95.** Shure 708A Mike **$8.95.** Banquet stand **$2.95.**

VM-406 3-SPEED CHANGER $33.21

World's finest 3-speed all automatic record player. 33⅓, 78 and 45 RPM. Intermixes 10 and 12" records on 33⅓ and 78. Priced complete with twin needles. Shipping weight 12 lbs. VM-406 Net **$33.21.** Above VM changer furnished with two plug-in General Electric variable reluctance cartridges. Stock No. VM-406GEX, with both cartridges. Shipping weight 13 lbs. Net **$37.90.**

Ever popular Webster 356, 3 speed automatic changer, with crystal cartridge and needle. Shipping weight 16 lbs. Net **$33.90.** 78 RPM record changer close-out sale. VM-400, intermixes 10 and 12" records. Shipping weight 14 lbs. Net **$12.95.** Crescent Model 950. Shipping weight 14 lbs. Net **$12.95.** Farnsworth, with Cathron broadcast quality V.R. cartridge and needle. Weight 18 lbs. Net **$12.95.**

Made to fit leatherette covered bases for any of the above changers **$1.95 extra.**

100 RADIO TUBES $29.95

250,000 Tubes for fast sale. Tremendous value. Tubes up to $3.00 list. 100 Cartoned and branded Hyvac Miniature Tubes for $29.95. Over a million sold. Guaranteed full replacement. 34c Each in smaller quantities.

1R5	12BE6	12AU6	6SU7	12S8	
1T4	12AT6	12BF6	6AQ5	9001	
1U5	35W4	6BA6	6AQ6	9003	6BA7
3A4	35Z5	6BE6	6C4	6BH8	6BJ6
1S5	50B5	6AT6	6K6	117Z3	35C5
3V4	12AT7	6AL5	6W4	19T8	
3Q4	12AU7	6AQ5	6AQ5	6BJ6	
3S4	12AX7	6BF6	6AU6	6AT6	
12BA6	12BA7	6AU7	6T8		

$29.95 for 100 — 34c each

Popular Gt tubes, individually cartoned and branded Hy-Vac. Any quantity 39c each.

1B4	6J5	6SD7	6SU7	12SF7	35Z5	**Popular G.T. Cartoned HY-VAC**
5V3	6J7	6SF5	6V6	12SJ7	50L6	
5Y4G	6K5	6SJ7	6X5	12SK7	70L7	
6AC5	6K6	6SK7	12A8	12SN7	80	
6BG6	6K7	6SL7	12BF7	12SQ7		
6C5	6P5	6SN7	12K8	25L6		
6C6	6S8	6SR7	12S8	32L7		
6F6	6SA7	6SS7	12SA7	35L6		

39c Each — Any Quantity

Hy-Vac 6AK5, 6J6, 49c each

STANDARD BRAND TUBES CARTONED and UNCARTONED 49c

0Z4G	1G6	5V4	6F7	6SA7	6T7	7B8	7S7	12F5	12SQ7	26
1A4	1H6	5Y3	6H6	6SC7	6V6	7C4	7V7	12H5	12SR7	27
1A5	1J6	6A3	6J5	6SD7	6X5	7C5	7Y4	12J5	12Z3	30
1B4	1L4	6AB7	6J7	6SF5	6Y6	7C6	7Z4	12K8	14A7	32
1B5	1R5	6AC7	6K5	6SF7	6Z7	7C7	10Y	12Q7	14B6	33
1C5	1S5	6AG7	6K6	6SG7	6ZY5	7E5	12A6	12SC7	14C7	34
1C7	1T4	6B8	6K7	6SH7	7A4	7E7	12A8	12SF5	14H7	35
1D5	1V	6C4	6K8	6SJ7	7A5	7F7	12AH7	12SF7	14Q7	35W4
1D7	2A5	6C5	6L5	6SK7	7A6	7H7	12AT6	12SG7	14W7	35Y4
1D8	2A6	6C6	6L7	6SL7	7A7	7L7	12BA6	12SH7	19	35Z4
1F4	2A7	6D6	6N7	6SQ7	7B4	7N7	12BD6	12SJ7	25L6	35Z5
1F5	3S4	6D6	6R7	6SR7	7B5	7Q7	12BE6	12SL7	25Z5	38
1G4	5T4	6F5	6S7	6SS7	7B6	7R7	12C8	12SN7	25Z6	39

6BE6	6F8	6K7	6SA7	6T7	7B8	7S7	12F5	12SQ7	26	43
6BY7	6G8	6L6	6SC7	6V6	7C4	7V7	12H5	12SR7	27	45Z5
41	6H6	6N6	6SD7	6X5	7C5	7Y4	12J5	12Z3	30	50B5
35B5	6J5	6P5	6SF5	6Y6	7C6	7Z4	12K8	14A7	32	56
3Q4	6J7	6S8	6SF7	6Z7	7C7	10Y	12Q7	14B6	33	57
14A8	6K5	6SN7	6SG7	6ZY5	7E5	12A6	12SC7	14C7	34	58
12J7	6K6	6SR7	6SH7	7A4	7E7	12A8	12SF5	14H7	35	70L7
6AT3	6K7	6S8	6SJ7	7A5	7F7	12AH7	12SF7	14Q7	35W4	75
6BA8	6K8	6SA7	6SK7	7A6	7H7	12AT6	12SG7	14W7	35Y4	76
	6L5	6SC7	6SL7	7A7	7L7	12BA6	12SH7	19	35Z4	77
	6L6	6SD7	6SQ7	7B4	7N7	12BD6	12SJ7	25L6	35Z5	78
	6L7	6SF5	6SR7	7B5	7Q7	12BE6	12SL7	25Z5	38	80
	6N7	6SF7	6SS7	7B6	7R7	12C8	12SN7	25Z6	39	

NAME BRAND 1½ VOLT LOCTALS, ETC.

1LN5	1LD5	1LH4	1LC6	1LA6	1LB4		
1LC5	1LG5	3LF4	1LE3	1LA4		69c	10 for $6.50
1A7	1N5	1A5	1N5	3Q5	1A7		
1Q5	1P5	1C5	1G4	1G6	117Z6	69c	
35A5	50A5 69c Each.						

Scoop 6L6 Tubes. Best Quality, branded, offered by McGee at **$1.09** each; 10 for **$10.00.**

Standard Brand Tubes, fully guaranteed. New and perfect.

12SA7	89c	12SK7	89c
35L6	89c	50L6	89c

10 of any of these for **$8.50**

XMAS SPECIAL RECORD PLAYER KIT

ON SALE FOR DEC. ONLY $9.95

COMPLETE KIT
Stock No. VV-1
Only $9.95

Buy this complete record player. Everything furnished including an attractive walnut cabinet with hinged lid. 78 RPM phono motor and light weight crystal pickup. You wire the amplifier from parts, tubes and schematic which are furnished. Has 4" PM speaker. This makes an ideal Christmas gift. It is attractive, plays good and is worth $15.00. Shipping weight 14 lbs. Stock No. VV-1. Net $9.95.

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Prices F.O.B. K.C. Send 25% Deposit with Order. Balance sent C.O.D. With Parcel Post Orders, Include Postage.

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI

REGULAR $32.50 LIST

MODEL CR-13X

"COAXIAL" 12 INCH P.M. SPEAKER

ON SALE **$12.95**

NATIONALLY FAMOUS MAKE
WIDE RANGE 40 TO 17,000 CPS
WORLD'S FINEST SPEAKER
VALUE FOR MUSIC LOVERS

Newly designed by one of America's finest speaker builders. Made for FM and AM high fidelity radios and record players. This speaker is incorporated in radios of the 500 dollar bracket. It has an especially designed 12" 6.8 oz. Alnico V Magnet PM for the low range Woofer and a coaxially built in 3" Alnico V tweeter for the extended high range. The high pass filter is concealed under the pot cover. Just hook to any 8 Ohm output transformer. Will work in place of any home radio speaker as most speakers have an 8 Ohm Voice Coil, only 2 wires to connect. Will handle 18 Watts peak. Wide range response 40 to 17,000 Cycles. This speaker should sell for $35.00. Why buy any ordinary speaker when we offer a 12" Coaxial PM for only $12.95. Shipping weight 8 lbs.

Model CR-13X, $12.95. Two for.....$24.95

15 INCH KING COAXIAL SALE PRICE $24.95

"IT WOOFS AS IT TWEETS"

The King Coax. A 21.5 oz. 15 inch Alnico V PM speaker with a built-in high frequency tweeter. Will respond to from 35 to 17,000 cycles. This is a ruggedly built speaker with a curvilinear one piece molded cone. Built-in high pass filter. Just hook to any 8 ohm output. Built by the maker of our ever popular 12 inch coax model CR-13X. This speaker has a retail list of over $60.00. We offer you our 5-15X 15 inch coax for only **$24.95.** Shipping weight 16 lbs.

MODEL 15-LS
15" 50 WATT P.M.
$16.95

MODEL 15-KR
15" JUKE BOX
$9.95

MODEL A-50
12" 50 WATT P.M.
$14.95

15 INCH DELUXE 50 WATT P.M. $16.95

Model 15-LS, 15" 21½ oz. Alnico V Magnet PM Speaker. Will take 35 watts with ease. Thousands of dollars were spent in building the fine tools to produce this speaker. The 8 ohm voice coil is 1½" in diameter and has been heat treated and plastic coated. Constructed to eliminate loose voice coils, wires and warping. Made by a renowned builder of fine speakers. Truly the King of juke box speakers. Shipping weight 14 lbs. Net Price **$16.95.** Two for.....$32.95

15 INCH "JUKE BOX" P.M. ONLY $9.95

Model 15-KR—Pre-War or Post-War, you never bought a speaker like this for such a scoop price. Made by a nationally known builder of fine speakers. A full 15" 12½ oz. Alnico V magnet speaker of juke box quality. Has standard 8 ohm voice coil. Will take up to 18 watts average or 25 watts peak. Here is a speaker that will bring out those low notes. Latest 1948 production; not line through-outs. Every speaker is guaranteed new and perfect. We may not be able to continue this offer for long, so place your order now. Stock No. 15-KR. INCLUDE POSTAGE. Wt. 10 lbs. **A $35.00 value for only....$9.95**

12 INCH 50 WATT SUPER HEAVY DUTY P.M. $14.95

Model A-50—12", 50 watt super heavy duty permanent magnet speaker. Has 1½" 8 ohm treated voice coil and one piece molded cone. Heavy half inch machined pot, with bolt secured 21 oz. Alnico V magnet. Frame is of heavy construction with metal pot cover. Finished in silver-grey enamel. This speaker is the best value possible today. Efficiency is two to three times that of ordinary speaker. Especially recommended for all public address systems and high quality home audio systems. Will handle 35 watts with ease and 50 watts peak or short lengths of time. Its retail value is $50.00. But, by our large purchase, we are able to offer it to you for only **$14.95.** Do not confuse this speaker with surplus merchandise. This is the latest production. Model A-50. Shipping weight 13 lbs. Net **$14.95.** 2 for.....$29.00

RADIO SERVICEMEN — DEALERS — MCGEE IS AFTER YOUR SPEAKER BUSINESS!

12" WIDE RANGE P.M. SPEAKER $7.95

Wide range 6.8 oz. Alnico V PM speakers. Curvilinear molded cones with 1¼" 8-ohm voice coils. Offered in 6-, 8- and 12-inch sizes. Response from 60 to 10,000 c.p.s. Top quality by a nationally known maker.

Model 6-L1—Wide range 6" speaker.....$4.95
Model 8-L1—Wide range 8" speaker.....5.95
Model 12L1—Wide range 12" speaker.....7.95

BIG BARGAINS IN 4 OHM AUTO SPEAKERS

4" 4 ohm field speaker.....$1.49
5" 4 ohm field speaker.....1.49
6" 4 ohm field speaker, square.....1.49
6½" 4 ohm field speaker, round.....1.49
7" 4 ohm square. Philco Motorola.1.98
8" 4 ohm field speaker.....1.98
Made by Magnavox and Cinaudagraph.

SPECIAL AUTO SPEAKERS

5½", 4 ohm auto speaker, made by Magnavox. Fits some Motorola sets. A real hot number. Special, only.....99c
6x9" Magnavox, 4 ohm heavy duty auto speaker. Original equipment for General Motors auto radios. Special.....$1.95

3000 SPEAKERS 450 OHM FIELD WITH P.P. 6K6 OUTPUTS

HERE'S THE GREATEST SPEAKER VALUE EVER

10" 450 ohm, with P.P. 6K6 output.....$1.99
8" 450 ohm, with P.P. 6K6 output.....1.99
6x9" 450 ohm with P.P. 6K6 output.....1.99

All factory cartoned. **$1.99** each or buy 10 assorted for **$18.50.** These speakers produced for Majestic by Utah Celtron and Carbonams. Buy for less than half of the factory cost.

POPULAR FIELD COIL SPEAKERS

5" Utah 450 ohm speaker, with output for 50L6. This is a quality 5" speaker. Has full size coil and humbucking coil. A real special.....$1.49

4x6" 450 OHM OPERADIO

4x6", 450 ohm speaker, made by Operadio. Special, only.....99c
3½" PM, 1.47 oz. Alnico V magnet, from Majestic factory. 3.2 ohm voice coil. Ideal for general replacement. Scoop price, 88c each, 10 for **$8.00.**
5x7" Utah PM with 1.47 oz. Alnico V magnet and shilded 50L6 output transformer attached. Popular in light model sets. While our stock lasts, **$1.77** each, 10 for **$16.95.**
4x6" PM with 1.47 oz. Alnico V magnet with 50L6 output attached. **$1.77** each, 10 for **$16.95.**
6x9" Magnavox, 1000 ohm field with humbucking coil. This model used in late phono combinations. Special at **$1.99,** 10 for **$18.00.**
6x9" Magnavox, 2000 ohm field with humbucking coil. This speaker would cost twice as much in regular line. Pickup from the factory makes price of **$1.99** each, 10 for **$18.00** possible.
6½" round Magnavox with 7000 ohm output for 6K6 attached. Has humbucking coil. A scoop at **$1.99,** 3 for **$9.00.**

ALUMINUM VOICE COIL

REPLACEMENT SPEAKERS—FACTORY PRICES

McGee's Aluminum Voice Coil Double X Line. McGee offers you our Double X line of replacement P.M. Speakers. Made by a pioneer of the aluminum voice coil speakers. All of the Double X speakers have Alnico V magnets. All aluminum voice coils with RMA standard 3.2 ohm impedance. Why pay twice as much for a replacement speaker? McGee buys them by the carload and sells them for half price. Every speaker is unconditionally guaranteed.

Double X Aluminum Voice Coil, Alnico V Magnet, RMA 3.2 ohm V.C.

Stock No.					
4XX	4" square	1 Oz. Mag.	$ .99 ea.,	10 for	$ 9.50
5XX	5" round	1 Oz. Mag.	.99 ea.,	10 for	9.50
6XX	6" pincushion	1.47 Oz. Mag.	1.69 ea.,	10 for	14.95
6XX2	6" pincushion	2.15 Oz. Mag.	1.95 ea.,	10 for	17.95
46XX	4x6"	1 Oz. Mag.	1.49 ea.,	10 for	13.95
57XX	5x7" oval	1.47 Oz. Mag.	1.95 ea.,	10 for	17.95
7XX	7" pincushion (Auto set)	3.15 Oz. Mag.	2.79 ea.,	10 for	24.95
8XX	8" pincushion	3.16 Oz. Mag.	2.95 ea.,	10 for	27.95
69XX	6x9" oval	3.16 Oz. Mag.	2.95 ea.,	10 for	27.95

5,000 4" AND 5" PM'S

5,000 4 and 5" PM's, 1 oz. Alnico V with mounting bracket. When McGee buys a bargain, so can you. Made by Permadux. All brand new factory cartoned. Every speaker guaranteed perfect. Buy yourself a good supply at manufacturer's cost. Only 5,000 to sell, each.....$0.89
Buy 10 assorted speakers, 10 for.....8.50

SALE ON OUTPUTS

Regular Universal Output Transformers

2,000-14,000 ohms to voice coil.
4 watt, universal output.$0.79
8 watt, universal output. .99
12 watt, universal output. 1.19

Special Push-Pull Output Transformers

Small 1½" push-pull, for 50L6.....49c
¾", push-pull trans., for 6K6.....59c
¾", push-pull trans., for 6V6.....59c

Small Equipment Output Transformers

2,000 ohm, for 30L6 output.....$0.39
5,000 ohm, for 6V6 output.....39
10,000 ohm, for 3Q5 output.....39
Assortment of 10 of these trans....3.50

Push-Pull 6L6 Output Transformers!!!!

Special chrome plated, fully shielded heavy output transformer, for push-pull 6L6's. Made for Scott. A real $5.00 value. Your net price only.....$2.95

SALE! MAGNAVOX P.M. SPEAKERS 12" $4.95

Genuine Magnavox PM speakers, with 22 oz. Alnico 3 magnet and 8 ohm voice coils. Ideal for P. A. and general replacement use.
12" 22 oz. Alnico 3 Magnavox **$4.95, $4.90** each in lots of 3.
8" 22 oz. Alnico 3 Magnavox **$2.95, 10 for $27.95.**

HIGH FIDELITY OUTPUT TRANS. 20 20,000 CPS ONLY ... $6.95

A-403—6600 ohms. Plate to Plate.

BEST VALUE IN U.S.A.

Why pay $20.00 or $30.00 for an output? Supreme quality and high fidelity output transformer. Designed to match push-pull plates (2—6L6 or 2—6V6, or 2—6AQ5) class AB, to 4-8-15-250 and 500 ohm; with 10% feedback winding. Housed in a compound filled case; 3⅞x4½x3". Actual net weight, 6 lbs. If you want the best quality from your audio system, order this transformer. Response essentially flat from 20 to 20,000 cycles. We have tried several high fidelity outputs in our lab and find this to be the best value. Even though your amplifier only puts out 10 or 15 watts, this 34 watt job is what you should have. Connecting instructions are furnished. Stock No. A-403, shipping weight 8 lbs. Net price...**$6.95**

40 WATT OUTPUT "CAPEHART" $7.95 HIGH FIDELITY

Stancor built for Capehart for this finest combination. 40 watt capacity all windings interwound to increase high frequency response and decrease capacity losses. High inductance in coils makes for best efficiency at low audio frequency. This high fidelity output transformer is fully shielded and has a net weight of 6 lbs. Made to match push pull 6L6 tubes 5,000 ohm plate to plate. Has tertiary winding for 10% feed back and voice, coil windings of 4 and 8 ohms. Frequency response plus or minus 2 DB from 30 to 15,000 cycles. Down 6DB below 20 cycles and above 20,000 cycles. Furnished with connecting instructions. Size 3½x4x4¾. Shipping weight 8 lbs. Stock No. 8X-55, net.....$7.95

CONSOLE BASS REFLEX SPEAKER BAFFLE $19.95

6 Cubic Foot Utility Bass Reflex Speaker Baffle. Size 32x22x16. Heavy construction with curved pleasing lines. Celotex lining assures non-rattle reproduction. Brown leatherette covered. Chrome front trim. Specify when ordering whether for use with a 12" or 15" speaker. Weight 40 lbs. This is an ideal baffle for our deluxe Coaxial model CR-13X. Baffle Stock No. NA-12. Net **$19.95.** CR-13X 12" Coaxial PM Speaker and NA-12 Baffle both for **$29.95.** You will be pleased with the fine tone of this combination.

PLASTIC GRILL SPEAKER BAFFLES

Juke-box operators, Sound men, here is the prettiest line of speaker baffles you have ever seen. Tri-color curved plastic grills. Good plywood construction, with matched leatherette-covered sides.

12 IN. WALL BAFFLE $3.95

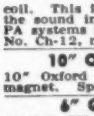
12" slanting wall baffle, with curved plastic grill. Stock No. 12-R: **$3.95.** Buy 4 for only **$14.95.**

8-10 IN. WALL BAFFLE $2.95

8" or 10" Flat mounting wall baffle, with plastic grill. Will hold either 8" or 10" speaker. Stock No. 8R: Your cost, **$2.95** each; 4 for **$10.95.**

12 IN. CORNER BAFFLE $3.49

Unique design 12" corner mounting baffle. Mounts snugly into corner, giving best sound distribution. Plastic front. Stock No. 12-C: Your cost, **$3.49** ea.; 4 for **$12.95.**



HIGH QUALITY P.M. For Use With Above Batteries 12" P.M. $4.95

12 inch PM with 6.8 oz. Alnico V magnet. 8 ohm voice coil. This is the standard 12 inch PM of the sound industry. Ideal for juke boxes, PA systems and extension speakers. Stock No. Ch-12, net **$4.95;** three for **$13.95.**

10" OXFORD PM SPEAKER

10" Oxford PM speaker. 7 oz. Alnico V magnet. Special, half price.....$3.49

6" G.E. PM and output

6" G.E. PM speaker. 3 oz. Alnico V magnet, with 8000 ohm output transformer. A $5.00 value. A honey for.....$2.49

Here's a sizzler. 8" Utah PM, with 4.64 oz. Alnico V magnet and 1" voice coil. A $5.00 wholesale value. Special....$2.98

6½" QUAM and output

6½" Quam PM speaker. 2.15 oz. Alnico V, with 50L6 output transformer. A $4.00 value. Special, only.....$1.98

SALE AC LINE CORDS For Radio Set Replacement

6½ ft. G.E. plastic AC cord and cap...10c
8 ft. G.E. plastic AC cord and cap....22c
6 ft. rubber AC line cord, bakelite plug. Special sale price.....15c

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PRICES F.O.B. K.C. Send 25% Deposit with order. Bal. Sent C.O.D. With parcel post orders include postage.

TELEPHONE VICTOR 9045. Write for Flyer
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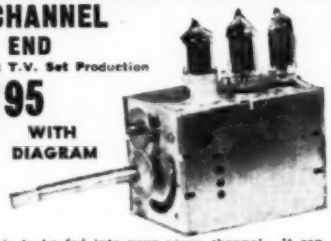
800 TELEVISION MAGNIFIERS ON SALE AT McGEES FOR LESS THAN COST OF MFG.

SARKES TARZIAN 13 CHANNEL TELEVISION FRONT END



This Popular T.V. Tuner is Used on Current T.V. Set Production

SALE PRICE $7.95 WITH DIAGRAM

SARKES-TARZIAN. 13 channel tuner for Television receiver. This 3 tube front end is all wired, including tube sockets. The same T.V. front end as used by several nationally known manufacturers. Built in fine frequency trimmer. Offered with printed schematic diagram. Priced complete with 3 tubes, 6C4 osc., 6AG5 mixer, and 6BH6 RF amplifier. This unit is worth twice our price. All wired, output is to be fed into your video channel. It can be mounted and used with the Farnsworth GVZ-60 chassis, advertised to the left. Weight 2 lbs. Stock No. SK-T3. Net price, Sarkes-Tarzian, 13 channel tuner, with 3 tubes **$7.95**

Stock No. IT-SK3. Same as above only without fine frequency vernier drive. This type used in intercarrier circuits. Furnished with tubes and diagram. Stock No. IT-SK3. Net **$6.95**

Farnsworth Television Chassis Scoop.. $5.95

Farnsworth Television Chassis Model GVZ60 partially built up Chassis. Size 12 x 17. Has 16 Tube sockets and over 150 small parts (Resistor and Ceramic Condensers) no coils or Transformers or tuning unit. Sweep and sync circuits are all partially wired up. This T.V. Chassis is ideal for the student and experimenter. Learn T.V. by building your own set using this chassis to start from. Furnished with a 1948 regular $3.00 Supreme Publications Television Manual, which has a complete schematic of this chassis as well as 9 pages of service information. If you want to play with Television here is a chance to get started. Farnsworth GVZ60 partially built up Chassis and 48 Supreme T.V. Manual all for $5.95. Include postage for 11 lbs. GVZ60 Chassis only **$2.95**

T.V. POWER TRANS. SCOOP PRICE $2.95

Order This With Your Farnsworth T.V. Scoop Chassis

GVZ60 Power Transformer, C-94230Z. 135 Mil Tapped 110 Volt primary. Supplies plate voltage and filament for part of Farnsworth T.V. Chassis. 375 V.D.C. 6.3 and 5 filament. Shipping wt. 7 lbs. Scoop price **$2.95**

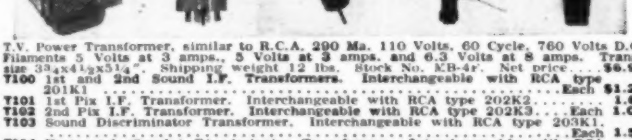
SALE ON T.V. PICTURE TUBES

Guaranteed first line Television picture tubes. Made and branded for a nationally known set manufacturer. Every tube guaranteed.

10 inch 10BP4 picture tube **$19.95**
12 inch 12LP4 picture tube **27.95**
16 inch 16AP4 all glass picture tube **45.95**

TELEVISION COMPONENTS COST LESS AT McGEE

MODEL	DESCRIPTION	NET
T118	Horizontal Deflection Output Transformer, Interchangeable with RCA Type 211T1 or 211T3	$4.49
T117	Vertical Oscillator Transformer (Blocking). Interchangeable with RCA type 208T2	1.59
T122	Focus Coil, 247 Ohms D.C. Resistance. Interchangeable with RCA type 202D1	2.49
T121	Deflection Yoke, 8.3 MH. Vertical 50 MH. Interchangeable with RCA type 201D1	3.49
T116	Vertical Deflection Output Transformer. Interchangeable with RCA type 204T2	1.95



T.V. Power Transformer, similar to R.C.A. 290 Ma. 110 Volts, 60 Cycle, 760 Volts D.C. Filaments 5 Volts at 3 amps., 5 Volts at 3 amps. and 6.3 Volts at 8 amps. Trans. size 3¾x4½x3¼. Shipping weight 12 lbs. Stock No. KB-4r. Net price ... $6.95

T100	1st and 2nd Sound I.F. Transformers. Interchangeable with RCA type 201K1 ..... Each	$1.29
T101	1st Pix I.F. Transformer. Interchangeable with RCA type 202K2	1.69
T102	2nd Pix I.F. Transformer. Interchangeable with RCA type 202K3 ..... Each	1.08
T103	Sound Discriminator Transformer. Interchangeable with RCA type 203K1. ..... Each	1.59
T104	Horizontal (Synch.) Discriminator Transformer. Interchangeable with RCA type 208T5. ..... Each	1.49
T105	3rd and 4th Pix Coils. Interchangeable with RCA type 202L1 ..... Each	.39
T106	Cathode Trap Coil. Interchangeable with RCA type 202K4	1.29
T107	Video Peaking Coil, 250 MH. Shunt Resistance 10 Megohms. Interchangeable with RCA type 202L1. ..... Each	.27
T108	Video Peaking Coil, 250 MH. Shunt Resistance 22,000 Ohms. Interchangeable with RCA type 203L2 ..... Each	.27
T109	Video Peaking Coil, 120 MH. Shunt Resistance 10 Megohms. Interchangeable with RCA type 203L3. ..... Each	.27
T110	Video Peaking Coil, 93 MH. Shunt Resistance 10 Megohms. Interchangeable with RCA type 203L4 ..... Each	.27
T111	Filament Chokes, .8 MH. Interchangeable with RCA type 204L1 .... Each	.15
T112	Width Control Coil. Interchangeable with RCA type 201R1. ..... Each	.48
T113	Horizontal Linearity Control Coil. Interchangeable with RCA type 201R3. ..... Each	.48
T114	Audio Single Output Transformer (speaker) for 6K6 Tubes. ..... Each	.80

G.I. 13-CHANNEL T.V. TUNER

LOW COST MAKES TUNER IDEAL FOR THE EXPERIMENTER

$1.95 KIT OF TUBES 99c

G.I. 13 channel television front end of the slug tuning type. Built-in fine frequency control. These tuners in good condition except one of glass coil forms may be cracked, can be repaired with service cement. These tuners are ideal for set building or booster building. Shipping weight 3 lbs. Stock No. BL-12. Net **$1.95**
Require 6C4, 6AG5, 6BH6. Kit of tubes **99c** extra.

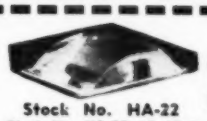
BOOKS ON T.V., ETC.

Howard Sams T.V. course, 216 pages. Net **$3.00**
Howard Sams T.V. Antenna Book, 102 pages. Net **1.28**
Supreme 1948 T.V. set diagrams. Net **3.00**
Supreme 1949 T.V. set diagrams. Net **3.00**

T.V. SLUG TUNED COILS

10 assorted small slug tuned coils for RF and osc. Same as used on T.V. tuners. Small bakelite forms with screw driver adjustment.

Stock No. PW-10. 10 asst. for **99c**



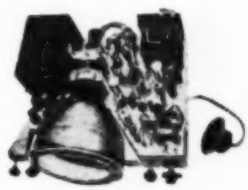
Stock No. HA-22

REGULAR $25.00 TELEVISION MAGNIFIER FOR 7-10-12 INCH TUBES

Sale Price $7.95

Stock No. HA-22 12x17 in. television magnifier. Made of crystal clear plastic and oil-filled. Magnifies your present 7-, 10-, or 12-inch television picture up to four times. We offer you these new factory cartoned magnifiers, you provide your own means of mounting to your set. Edge of magnifier may be drilled and hung on your set with cord. This lens is a $25.00 value, but McGee offers them to you for only **$7.95**. Include postage for 22 lbs.

30-TUBE T.V. CHASSIS BUILT FROM RCA MATERIAL

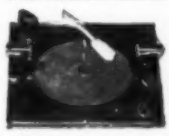


16 INCH $169.95

With all tubes except picture tube

12 INCH $159.95

This is not a kit but a complete 30 tube Television receiver chassis, made by a famous company, from RCA parts. Price includes all tubes except the picture tube. This is our best value in a T.V. chassis for custom installation. Order now. 16" T.V. chassis Stock No. RCA-3016 with all tubes, less picture tube. Net **$169.95**. 16" picture tube **$50.00** extra. (Picture tube not sold without chassis.)
12" T.V. chassis. Stock No. 3012 with all tubes, less picture tube. Net **$159.95**.
12" picture tube, Net **$27.95** extra.



CAPEHART AUTOMATIC RECORD CHANGER SCOOP $6.95

While our stock lasts we offer these Capehart changers for only $6.95 each. Plays 10-12" or 12-10" records automatically. These changers are in good condition, but have been removed from sets to make way for 3 speed changers. They need adjusting, however, you service men with a little ingenuity can put them to profitable use. These changers are equipped with True Timber Variable Resistance Cartridge with permanent needle. (Requires same gain as G.E. Variable Reluctance.) Connecting instructions furnished. Base size 14¼x 14¼". Shipping weight 23 lbs. Extra pick up arm with Standard Crystal Cartridge $1.00 extra. Stock No. 71-WL. Net **$6.95** each. 2 for **$12.95**.

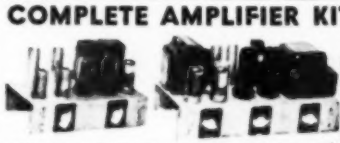
PROTECT YOUR EYES— SAFETY GOGGLES—$2.49

Protect your eyes with these clear plastic safety goggles. Easy to wear even over eye glasses. Television picture tubes are dangerous to handle without protection. Don't take the risk. Order a pair of safety goggles from McGee.
Stock No. SG-1. Net **$2.49**

Sale McGRADE $11.95

McGrade Intercom. Master and sub-station, housed in small matching walnut plastic cabinets, 5¼x7x3½ inches. Sloping front for desk or wall installations. Furnished with 50 feet of inter-connecting wire. Sub-station may be used up to 1000 feet from master station. These units are new and factory cartoned. Complete with tubes. Made to retail at $29.95. A lucky purchase enables us to offer these to you for only **$11.95**. Include postage for 8 lbs. Stock No. MG-25.

COMPLETE AMPLIFIER KITS AT McGEE FOR LESS

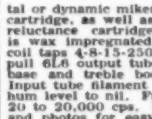


TM-12—12 WATT KIT $10.95 **TM-20—20 WATT KIT $15.95**

Kit Model TM-12. 12 Watt Amplifier Kit. Ideal for a high quality record player as a P.A. System or recording amplifier. Matched component parts ready punched chassis. One control fades from phono to mike. Input compensation for G.E. Variable Reluctance pick up. Output matches 8 ohm Voice Coil. 100 Mill Power Transformer. Complete with tubes, diagram and photos. 2—6V6, 2—12AX7, and rectifier. Variable tone control. Model TM-12. Weight 10 lbs. Net **$10.95**. Crystal utility mike and desk stand $4.95 extra. TM-12 custom wired and tested $4.00 extra.

Kit Model TM-20. A high quality 20 Watt Audio Amplifier with 135 Mill Power Transformer and push-pull 6L6's. Inputs for mike or phono pickup. Compensation for G.E. Variable Reluctance pick up. Tone and fader controls. Has heavy duty universal output transformer, to match 8 ohm P.M. Speaker. Ready punched chassis. Price includes tubes, diagram and photos. 2—6L6, 2—7N7, 7Z4. Frequency response 50 to 9,000 Cps. Kit Model TM-20. Weight 20 lbs. Net **$15.95**. TM-20 custom wired and tested $5.00 extra.

Kit Model TM-8. Similar in size and shape to Model TM-12. 8 Watt amplifier Kit for utility use, record playing, or paging. Matched component parts. Ready punched chassis. Variable tone control. One Control fades from mike to phono. Input compensation for G.E. Variable Reluctance pick up. Output matches 8 ohm Voice Coil, 75 Mill Power Transformer. Price includes tubes, diagram and photo. Push pull 6AQ5, two 12AX7, plus rectifier. Kit Model TM-8. Weight 8 lbs. Net **$8.95**. Crystal mike and utility desk stand $4.95 extra. Model TM-8WT amplifier is TM-8 kit wired ready to operate, net **$11.95**.



WIDE RANGE AMP-KIT $29.95

It's the newest thing in audio amplifiers, McGee's wide range, 34 watt amplifier kit with inputs for crystal or dynamic mikes and any crystal phono cartridge, as well as the new G.E. variable reluctance cartridge. Output transformer is wax impregnated, weighs 6 lbs. Voice coil taps 4-8-15-250 and 500 ohms. Push-pull 6L6 output tubes. Separate electronic bass and treble boost. Inverse feedback. Input tube filament is DC heated to reduce hum level to nil. Frequency response from 20 to 20,000 cps. Easy to follow diagram and photos for easy assembly of this kit. Ready punched chassis. Every part furnished, including tubes: 2—6L6, 5V4, 3—12AX7. Shipping weight 25 lbs. Stock No. XX-34, net **$29.95**.

T.V. BOOSTER—REGENCY—$17.61 ANCHOR—$22.05

Regency DB-213 low and high band television booster. Dual 6J6 tubes with iron core push pull RF amplification. For either 73 of 300 ohm inputs. With booster off. Ant. is connected direct to receiver. Weight 3 lbs. Net ... **$17.61**

Anchor Model ARC-101-50. Ever popular low and high band TV booster. Carefully engineered and finely constructed. Ship. weight, 6 lbs. Net **$22.05**

RT-44LL NET $6.75 **RT-40LL NET $6.44**

TELEVISION ANTENNAS—ON SALE

Television Antennas. Best prices. Top quality. It's McGee for T.V. Conical Model RT-44LL, as pictured with 8 foot mast, bracket and foot mount. Dealers net **$6.75**. Conical element for stacking, on the above antenna. Same as above antenna but less mast. Net ... **$4.49**
Stacking jumper bars ..... **90c** per pair
Hi-Low folded dipole with reflector as pictured, with 8 foot mast, bracket and foot. This is the ever popular model for metropolitan reception.
Stock No. RT-40LL. Net **$6.44**
Low band folded dipole with reflector, 8 foot mast, bracket and foot mount.
Stock No. RT-42LL. Net **$5.25**
Low band folded dipole element with reflector for stacking, on the above antenna.
Stock No. RT-82. Net **$3.49**
Stacking jumper bars ..... **90c** per pair
300 ohm twin lead transmission line, top quality. 100 foot roll **$1.49**. 1000 feet for **$13.00**
Federal twin transmission line K-111. 100 feet for **$11.25**. 1000 feet for **$105.00**

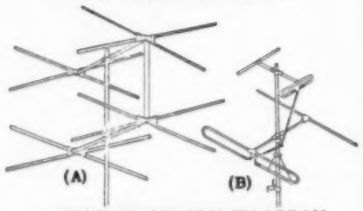
McGEE RADIO COMPANY

PRICES F.O.B. K.C. Send 25% Deposit with order. Bal. Sent C.O.D. With parcel post orders include postage.

TELEPHONE VICTOR 9045. Write for Flyer
1422 GRAND AVE., KANSAS CITY, MISSOURI

If you don't receive our
FREE BARGAIN CATALOGS
you're losing money!

TV Money Savers!
TV ANTENNAS



A STACKED CONICAL TV ARRAY
High gain, all band, TV array at amazingly low cost. Direct coupling to 72, 150 or 300 ohm line with minimum loss. All dural construction. 10 foot mast included. Shpg wt: 16 lbs. Cat. No. Q852..... $11.95

B HI-LO DIPOLE AND REFLECTOR
An ALL-BAND TV antenna that's easy to install, trouble-free and highly efficient. Corrosion resistant. 8 foot steel mast. Adjustable mounting base and bracket. All elements securely locked. Dipole and reflectors of hard aluminum to prevent twisting and turning. Separate orientation for each bay. Shpg wt: 13 lbs. Cat. No. Q802..... $5.97

TUBES Can't mention name; top brand, fully guaranteed!

1B3GT.	$1.40	6BG6G.	$2.10	6AK5...	$0.99
6AG5...	1.00	6J6.....	1.10	12SN7GT	.79
6AL5...	.79	6SN7GT	.79	6AG7...	1.40
6AU6...	.79	6K6GT.	.65	6V6GT.	1.10
6BA6...	.75	5U4G...	.65	6SH7...	.55

:: Packed in manufacturer's or white boxes ::

Federal's K-111 300 ohm shielded transmission line

All the advantages of 300 ohm twin-lead and coaxial cable combined. Minimize ghosts and noise. 100 ft, $9.90. Ft..... 11¢

Fine quality, 20 guage twin-lead. 1000 ft, $11.25; 100 ft, $1.25; per foot..... 1½¢

Famous Manufacturer

A All 110/120V, 60 cycle pri. Dull black case.
Fig. A, 720VCT @ 160 ma; 6.3VCT @ 4A; 5V @ 3A. 7 lbs. Cat. No. Q203..... $2.95
Fig. A, 800VCT @ 200 ma; 6.3VCT @ 4A; 5V @ 4A. 9 lbs. Cat. No. Q204..... $3.95
Fig. B, 700VCT @ 100 ma; 6.3V @ 4A; 5V @ 3A. 6 lbs. Cat. No. Q233..... $2.39
Fig. C, 200 ma. choke. 4.5 hy. 100 ohms DC resistance. 3 lbs. Cat. No. Q206..... $1.39

TERMS: 20% deposit with order, balance C.O.D.

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CITY.....

International Short-Wave

(Continued from page 69)

9.670, 0030-0530 to Mid-Pacific (AFRS), and 0545-0915 to Marianas-Philippines (AFRS); WNRX, 9.670, 1930-2100 to East South America; KCBF, 9.700, 0400-0915 to Japan (AFRS); WOOW, 9.700, 1500-1730 to Europe; WLWS-2, 9.700, 1900-2200 to West South America; KNBX, 9.750, 0400-0915 to East Asia.

WLWS-1, 11.710, 1530-1730 to Europe; WLWR-1, 11.710, 1900-2200 to West South America; KGEX, 11.730, 0030-0345 to Mid-Pacific (AFRS), and 0400-0915 to Philippines-East Indies; KCBR, 11.770, 1900-2100 to South America; KRHK, 11.790, 0400-0915 to East Asia; WRUS, 11.790, 1300-1730 to Europe; WRUL, 11.790, 1930-2100 to East South America; KWIX, 11.860, 0330-0915 to Japan (AFRS); WGEA, 11.870, 1400-1730 to Europe; Manila I, 11.890, 0400-1045 to Far East, and 1745-2000 to East Asia; WNRX, 11.890, 1400-1745 to Europe (AFRS); KWID, 11.900, 0030-0630 to South Pacific (AFRS).

KNBI, 15.130, 1900-2100 to South America; WRCA, 15.150, 1300-1745 to Europe; KCBF, 15.150, 2015-0330 to Alaska-Aleutians (AFRS); WRUA, 15.210, 1030-1330 to Europe; WBOS, 15.210, 1400-1745 to Europe (AFRS); WRCA, 15.210, 1930-2100 to East South America; KNBX, 15.240, 1745-1900 to Hawaii; KNBX, 15.250, 0030-0330 to South Pacific (AFRS); WLWR-1, 15.250, 1100-1730 to Europe; Manila II, 15.250, 1745-2000 to East Asia; WCBN, 15.270, 1115-1730 to Europe, and 1830-2200 to South America; Munich I, 15.280, 1100-1200 to Europe-Middle East; WNRE, 15.285, 1230-1730 to Europe; Manila II, 15.330, 0400-1045 to East Asia; WGEO, 15.330, 1100-1730 to Europe; WLWR-2, 15.330, 1900-2200 to West South America; WLWR-1, 15.350, 0815-0900 to West South America; WRUL, 15.350, 1230-1730 to Europe; WRUA, 15.350, 2000-2100 to Central America.

WRUW, 17.750, 1030-1500 to Europe; Manila III, 17.760, 0400-1045 to East Asia; KWID, 17.760, 1900-2100 to South America; WGEX, 17.765, 1100-1745 to Europe; KCBF, 17.770, 1745-1900 to Philippines-East Indies; WNBI, 17.780, 1115-1730 to Europe, and 1830-2100 to South America; KRHO, 17.800, 1745-1900 to East Asia; WLWK, 17.800, 2000-2100 to West South America; WLWS-1, 17.830, 0815-0900 to West South America; WCBX, 17.830, 1100-1730 to Europe.

KNBA, 21.460, 1900-2100 to South America; WOOW, 21.500, 1115-1430 to Europe; WABC, 21.570, 1030-1645 to Europe, and 1830-2100 to South America; WGEA, 21.590, 1100-1330 to Europe; WLWS-1, 21.650, 1100-1500 to Europe; WLWL-1, 21.690, 1100-1730 to Europe; WNRX, 21.730, 1115-1330 to Europe, and WCBA, 21.740, 1745-1900 to East Asia.

In addition, transmitters are in operation at 0915-0945 and 2215-2245 in Russian. Due to jamming of these programs, the frequencies used are subject to change. KRHK and KRHO are at Honolulu; other stations *listed by call letters* are within the Continental United States.

(Other facilities of the "Voice of America" include medium-wave relays or rebroadcasts through arrangements with domestic networks or stations in France, Italy, China, Korea, Germany, Austria, Greece, Argentina, Bolivia, Brazil, Chile, Columbia, Cuba, Ecuador, Guatemala, Nicaragua, Peru, Uruguay, and El Salvador.)

Program hours are 28 hours daily—including 16½ hours to Europe; one-half hour to the Near East; 3¾ hours to Latin America, and 6½ hours to the Far East. (Not included are relay base rebroadcasts amounting to 28 program hours daily; e.g., original and rebroadcast Russian programs are beamed to the U.S.S.R. around the clock in an effort to pierce intensive Soviet jamming.)

Program content consists of news, 31 per-cent; analysis and features, 56 per-cent, and music, 13 per-cent.

International broadcast stations in the United States are listed as follows:

The Associated Broadcasters, Inc., San Francisco, Calif., KWID, 100kw., and KWIX, 50kw. (6.060, 9.570, 11.870, 11.890, 11.900, 15,290, 17.760, 21.610). *Columbia Broadcasting System, Inc.*, Brentwood, Long Island, New York, WCBN, WCBX, WABC, all 50kw. (6.060, 6.120, 6.170, 9.650, 11.830, 15.270, 17.830, 21.520, 21.570). *Columbia Broadcasting System, Inc.*, Wayne, New Jersey, WOOC and WOOW, both 50kw. (6.120, 9.650, 9.700, 11.810, 15.130, 17.830, 21.500). *Columbia Broadcasting System, Inc.*, Delano, Calif., KCBA, 50kw., KCBF, 50kw., and KCBR, 200kw. (6.170, 9.670, 9.700, 9.750, 11.770, 11.810, 15.130, 15.150, 15.330, 17.780, 21.460). *The Crosley Corporation*, Bethany, Ohio, WLWL, WLWR, WLWS, all 200kw. (6.080, 9.550, 9.700, 11.710, 11.810, 15.250, 15.350, 21.650, 21.690). *The Crosley Corporation*, Mason, Ohio, WLWK, 50kw., and WLWO, 75kw. (6.080, 9.590, 11.710, 11.790, 15.250, 17.800, 21.650). *General Electric Company*, Schenectady, New York, WGEA, 50kw., WGEO, 100kw., and WGEX, 25kw. (6.190, 9.530, 9.550, 11.770, 11.810, 15.330, 17.880, 21.500, 21.590). *General Electric Company*, Belmont, California, KGEI, 50kw., and KGEX, 100kw. (6.190, 9.530, 9.550, 9.670, 11.730, 11.790, 15.130, 15.210, 15.330, 17.780, 17.880). *National Broadcasting Co., Inc.*, Bound Brook, New Jersey, WNBI and WRCA, both 50kw. (6.100, 9.670, 11.870, 11.893, 15.150, 17.780, 21.630). WNRA, WNRE, WNRI, WNRX, all 50kw. (6.100, 9.670, 11.830, 11.870, 15.280, 18.160, 21.610, 21.730). *National Broadcasting Co., Inc.*, Dixon, Calif., KNBA and KNBI, 50kw., and KNBX, 200kw. (6.060, 6.120, 9.650, 9.700, 11.790, 11.890, 15.250, 15.330, 17.780, 21.630). *Westinghouse Radio Stations, Inc.*, Hull, Massachusetts, WBOS, 50kw. (6.140, 9.570, 11.870, 15.210, 17.780, 21.540). *World Wide Broadcasting Corp.*, Scituate, Massa-

MORE TUBES—LOWER PRICES!

ALL BRAND NEW

STANDARD BRAND

Type	Price
1B22	$ 4.95
1B23	9.50
1B24	4.95
1B25A	4.95
1B26	7.95
1B27	4.95
1B29	.89
1B32	4.95
1B38	49.50
1B40	4.95
1B59	12.95
1B60	4.95
1N21	1.00
1N23	1.00
1P23	1.95
2AP1	3.95
2C4	1.18
2C21	.98
2C22	.39
2C26A	.28
2C34	.59
2C40	3.95
2C43	9.50
2C44	1.75
2C46	7.50
2C51	6.50
2D21	1.18
2E22	1.50
2E24	4.95
2E25A	4.25
2E26	3.95
2E30	2.39
2J21A	12.95
2J26	8.95
2J27	14.95
2J30	19.95
2J31	19.95
2J32	24.95
2J33	24.95
2J36	75.00
2J37	24.95
2J38	24.95
2J49	24.95
2JB51	4.95
2J54B	24.95
2K23	24.95
2K25	24.95
2K28	24.95
2X2/879	.39
3AP1	4.95
3B22	4.95
3B23	4.95
3B24	1.98
3B24W	2.95
3B26	1.89
3B28	5.95
3BP1	3.95
3C23	4.95
3C24	.69
3C30	1.50
3C31	.69
3CP1	3.00
3DP1-A	3.95
3EP1	3.95
3E29	4.95
3FP7	3.95
3GP1	4.95
3JP7	7.95
4-65A	14.50
4-125A	27.50
4-250A	37.50
4A1	.98
4AP10	4.95
4C35	19.95
4J26	110.00
5AP1	4.95
5AP4	4.95
5BP1	2.95
5BP4	4.95
5C22	49.50
5CP1	3.95
5CP1A	9.95
5D21	29.95
5FP7	3.95
5GP1	2.95
5HP4	9.95
5J23	100.00
5J29	100.00
5JP2	11.95
5LP1	11.95
5MP1	4.95
5NP1	1.98
6AF6G	.88
6C21	24.95
6F4	5.95
6J4	4.95
7BP1	4.95
7BP7	4.95
7C23	75.00
7C24	80.00
7C25	90.00
7DP4	17.95
9C23	250.00
9GP7	15.00
9JP1	7.95
9LP7	15.00
9NP1	7.95
10Y	.69
10SPEC	.69
10BP4	24.50
10CP4	29.50
12DP7	14.95
12DP8	14.95
12FP7	14.95
12GP7	14.95
12HP7	$14.95
12KP4	49.50
12LP4	49.50
15E	1.50
15R	.98
23D4	.49
24G	.98
35T	4.95
45SPEC	.49
53A	24.95
75TL	3.95
100TH	12.95
100TS	3.00
101F	4.95
114A	.69
114B	1.25
120	5.95
121A	2.65
203A	16.95
205B	4.50
205F	4.50
211	.98
215A	3.00
218	49.50
221A	2.95
231D	1.49
249C	3.49
250R	7.95
250TH	19.50
252A	4.95
259A	4.95
262A/B	3.50
274B	1.25
275A	7.95
282A/B	9.95
283A	10.95
286A	10.95
290A	4.95
291A	4.95
294A	4.95
300A	3.95
301A	6.95
304B	5.95
304TH	6.95
304TL	1.49
307A	4.95
310A	7.95
315A	6.95
316A	.69
327A	4.95
338A	4.93
348A	5.95
350A/B	2.95
354C/D	19.95
357B	49.50
368AS	4.93
371A/B	.89
374A	2.50
393A	7.95
394A	2.50
399A	2.50
400A	3.25
401A	1.95
403A/B	1.75
417A	24.95
434A	7.95
446A/B	3.95
450TH	24.95
450TL	45.00
464A	9.50
527	12.95
531	24.50
532A	4.95
631P1	4.95
700B/D	49.50
701A	4.95
703A	4.95
705A	2.95
706AY	49.50
706CY	18.95
706GY	49.50
707A/B	24.95
708A	7.95
710A	2.95
713A	1.65
714AY	6.95
715A/B	9.95
715C	24.95
717A	.99
720DY	34.95
721A/B	4.35
723AB	7.95
724A/B	4.95
725A	9.95
726A/B/C	23.50
728GY	24.95
730A	24.95
750TL	49.50
800	2.25
801A	.98
802	4.25
803	8.95
804	12.95
805	5.95
807	1.25
808	1.89
809	2.93
810	7.95
811	2.45
812	2.95
812H	6.90
813	8.95
814	3.95
815	2.95
816	1.12
826	$ .69
829A/B	7.95
829B/3E29	4.95
830	2.95
830B	5.25
832/A	4.95
833A	34.50
834	5.95
836	1.15
837	2.50
838	3.95
841	.69
843	.69
845/W	4.95
849A/H	69.50
850	22.50
851	75.00
860	3.00
861	49.95
864	.69
865	2.98
866A	.99
866JR	1.19
872A	2.95
874	2.49
876	2.50
878	2.49
884	1.49
885	.98
889R	140.00
891	110.00
892	115.00
902P1	7.95
905	11.95
907	11.95
913	4.95
917	1.50
918	1.50
922	1.00
923	.98
925	1.40
930	1.00
931A	4.95
949A	69.50
950	.98
954	.75
955	.75
956	.75
957	.75
958A	.75
959	2.95
966A	.99
972A	2.95
975A	14.95
991	.75
1613	.75
1614	1.75
1616	1.39
1619	.75
1620	6.95
1621	.98
1622	1.75
1624	1.75
1625	.49
1626	.49
1628	4.95
1629	.69
1631	1.50
1633	.89
1634	.79
1636	5.95
1638	.98
1641	.79
1642	.98
1644	1.49
1645	1.98
1649	1.25
1665	1.19
1851	1.25
1852	1.06
1853	1.06
1960	.95
2050	1.19
2051	.98
5514	4.95
5516	5.95
5562	10.00
7193	.39
8005	4.95
8011	2.95
8012A	4.95
8013A	2.95
8014A	24.95
8016	1.49
8020	3.95
8025A	7.95
8026	12.95
BR	2.50
BH	4.95
C1A	4.95
C1B	4.95
C5B	12.95
C6A	9.95
C6J	12.95
CK1005	.35
CK1006	.69
CK1090	4.95
EF50	.79
EL1C	4.95
EL3C	4.95
F123A	12.95
F128A	79.50
F660	150.00
FG17	3.25
FG27A	9.95
FG32	5.95
FG33	8.95
FG81A	6.95
FG95	$ 9.95
FG105	19.95
FG172A	32.50
FG235	59.50
FG238B	160.00
GL146	11.00
GL473	65.00
GL502A	1.98
GL530	49.50
GL559	5.35
GL673	11.50
GL697	150.00
HF100	3.95
HF200	17.95
HF210	17.95
HF300	17.50
HK254	19.95
HV18	12.95
HY615	1.25
HYE1148	.48
KU23	15.00
KU610	9.95
ML101	150.00
MX408U	.49
PJ23	1.35
R100	3.75
R200	7.95
R1130	12.95
RK20A	7.50
REL36	.98
RK22	4.95
RK23	4.95
RK31	2.50
RK33	.98
RK34	.59
RK39	1.75
RK51	3.95
RK52	4.50
RK59	5.95
RK60	.79
RK62	1.98
RK63	12.95
RK65	24.95
RK72	1.95
RK73	3.95
RX21	3.95
RX120	10.00
T20	1.50
T21	1.75
T35	3.95
T200	10.95
TZ20	1.50
TZ40	2.95
UH50	5.95
UX200	.75
V70D	6.95
VR75	.98
VR78	.75
VR90	.75
VR91	1.49
VR105	.98
VR150	.75
VT127A	3.00
VU111	1.19
WL460	14.95
WL468	14.95
WL532A	4.95
WL562	150.00
WL616	105.00
Z225	1.95
ZB120	6.95
ZB3200	150.00
ZP477/12DP8	14.95
0A2	1.69
0A3/VR75	.98
0A4G	1.06
0B2	2.05
0B3/VR90	.75
0C3/VR105	.98
0D3/VR150	.75
OY4	.88
0Z4	.88
OZ4G	.88
01A	.50
1A3	.72
1A4	1.28
1A4P	1.56
1A5GT	.72
1A6	1.28
1A7GT	.80
1B3GT	1.49
1B4	1.56
1B5/25S	1.28
1B7GT	1.06
1C5GT	.88
1C6	1.28
1C7G	1.28
1D5GP	1.55
1D7G	1.28
1D8GT	1.56
1E5GT	1.38
1E7G	1.56
1F4	1.06
1F5G	1.06
1F6	1.56
1F7G	1.56
1G4GT	1.06
1G6GT	1.06
1H4G	.88
1H5GT	.66
1H6G	1.28
1H6GT	1.28
1J6GT	1.28
1L4	.80
1LA4	1.06
1LA6	1.06
1LB4	1.06
1LC5	1.06
1LC6	$1.06
1LD5	1.06
1LE3	1.06
1LG5	1.06
1LH4	1.06
1LN5	1.06
1N5GT	.88
1P5GT	1.06
1Q5GT	1.06
1R4	1.06
1R5	.80
1S4	.96
1S5	.72
1T4	.80
1T5GT	1.06
1U4	.80
1U5	.72
1V	.88
2A3	1.28
2A5	.88
2A6	1.06
2A7	1.06
2B7	.88
2V3G	1.98
2X2A	1.25
3A4	.39
3A5	1.49
3A8GT	1.98
3B7	.36
3D6	.36
3LF4	1.28
3Q4	.88
3Q5GT	.96
3S4	.80
3V4	.80
5AZ4	.63
5R4GY	1.15
5T4	1.28
5U4G	.60
5V4G	.96
5W4	1.06
5W4GT	.66
5X4G	.72
5Y3GT	.42
5Y4G	.60
5Z3	.72
5Z4	1.06
6A3	1.28
6A6	1.06
6A7	.80
6A8	.80
6A8GT	.80
6AB5/6N5	.88
6AB7/1853	1.06
6AC5GT	1.16
6AC7/1852	1.16
6AD7G	1.25
6AF6	1.28
6AG5	1.06
6AG7	1.28
6AH6	1.56
6AJ5	.99
6AK5	1.56
6AK6	.96
6AL5	.80
6AL7GT	1.06
6AQ5	.80
6AQ6	.72
6AQ7GT	.88
6AR5	.66
6AS7G	4.95
6AT6	.60
6AU6	.80
6AV6	.60
6B4G	1.28
6B5	1.56
6B6G	.88
6B7	1.28
6B8	1.28
6B8G	1.28
6BA6	.80
6BE6	.72
6BF6	.66
6BG6G	1.92
6BH6	.80
6BJ6	.80
6C4	.39
6C5	.66
6C5GT	.66
6C6	.80
6C7	1.28
6C8G	1.28
6D6	.66
6D8G	1.28
6E5	.85
6F5	.66
6F5GT	.66
6F6	.80
6F6GT	.66
6F7	1.06
6F8G	1.28
6G6G	1.06
6H6	.60
6H6GT	.60
6J5	.54
6J5GT	.54
6J6	1.16
6J7	.80
6J7GT	.80
6J8G	1.28
6K5GT	.96
6K6GT	.60
6K7	.66
6K7GT	.66
6K8	.96
6K8GT	.96
6L5G	1.06
6L6	$1.42
6L6G	1.16
6L6GA	1.16
6L7	.96
6L7G	1.16
6N6G	1.56
6N7	.96
6N7GT	.96
6P5GT	.96
6Q6G/6T7G	1.06
6Q7	.80
6Q7GT	.72
6R7	1.06
6R7GT	1.06
6S7	1.28
6S7G	1.28
6S8GT	1.06
6SA7	.66
6SA7GT	.66
6SB7Y	.88
6SC7	.72
6SD7GT	.49
6SF5	.66
6SF5GT	.72
6SF7	.80
6SG7	.80
6SH7	.39
6SJ7	.66
6SJ7GT	.66
6SK7	.66
6SK7GT	.66
6SL7GT	.96
6SN7GT	.88
6SQ7	.60
6SQ7GT	.60
6SR7	.72
6SR7GT	.72
6SS7	.66
6ST7	.88
6SV7	.88
6T7G	1.24
6U5/6G5	.72
6U6GT	.72
6U7G	.72
6V6/6V6G	1.28
6V6GT	.80
6W7G	.88
6X4	.60
6X5GT	.60
6Y6G	.96
6Y7G	.88
6Z7G	1.28
6ZY5G	.88
7A4/XXL	.72
7A5	.72
7A6	.72
7A7	.72
7A8	.72
7AD7	1.06
7AF7	.72
7AG7	.88
7AH7	.88
7B4	.72
7B5	.72
7B6	.72
7B7	.72
7B8	.72
7C4/1203A	.39
7C5	.72
7C6	.72
7C7	.72
7E5/1201	1.66
7E6	.72
7E7	.88
7F7	.88
7F8	1.06
7G7/1232	1.06
7H7	.80
7J7	1.06
7K7	1.06
7L7	.88
7N7	.88
7Q7	.72
7R7	.88
7S7	1.06
7Y7	1.06
7W7	1.06
7X7/XXFM	1.06
7Y4	.72
7Z4	.72
10	.69
12A	.60
12A6	.39
12A6GT	.29
12A7	1.28
12A8GT	.80
12AH7GT	.88
12AL5	.80
12AT6	.60
12AT7	1.16
12AU6	.80
12AU7	.96
12BA6	.72
12BE6	.72
12C8	.69
12F5GT	.72
12H6	.39
12J5GT	.39
12J7G	.80
12J7GT	.80
12K7GT	.66
12K8	.88
12K8GT	.96
12Q7GT	.72
12SA7	.66
12SA7GT	.66
12SC7	.72
12SF5	.80
12SF5GT	.80
2SF7	$ .80
12SF7GT	.80
12SG7	.72
12SH7	.39
12SJ7	.66
12SJ7GT	.66
12SK7	.66
12SK7GT	.66
12SL7GT	.88
12SN7GT	.80
12SQ7	.60
12SQ7GT	.60
12SR7	.39
12SR7GT	.39
12X3	.98
12Z3	.88
14A7/12B7	.88
14AF7/XXD	.88
14B6	.88
14B8	.88
14C5	.88
14C7	.88
14E6	.72
14E7	.88
14F7	.88
14F8	1.06
14H7	.88
14J7	1.06
14N7	1.06
14Q7	.88
14R7	.88
14S7	1.06
14W7	1.06
14X7	1.06
19	1.28
19T8	1.56
22	1.28
24A	.88
25A6	1.06
25A6G	1.06
25AC5GT	1.16
25L6GT	.66
25Y5	1.16
25Z5	.60
25Z6GT	.60
26	.72
27	.60
28D7	.39
30	.39
31	.39
32	1.28
32L7GT	1.28
33	.39
34	.38
35/51	.80
35A5	.72
35B5	.80
35L6GT	.66
35W4	.46
35Y4	.72
35Z3	.72
35Z4GT	.60
35Z5GT	.50
36	.39
37	.39
38	.39
39/44	.39
41	.66
42	.66
43	.66
45	.66
45Z3	.69
45Z5GT	.72
46	1.06
47	.96
49	.88
50	1.56
50A5	.88
50B5	.66
50C5	.66
50L6GT	.66
50Y6GT	.72
53	1.06
56	.72
57	.80
58	.80
59	1.06
70L7GT	1.56
71A	.80
75	.66
76	.66
77	.66
78	.66
79	.88
80	.46
81	1.56
82	1.06
83	1.06
83V	1.28
84/6Z4	.72
85	.88
89	.72
89Y	.39
117L7GT	1.56
117M7GT	1.56
117N7GT	1.56
117P7GT	1.56
117Z3	.60
117Z4GT	1.16
117Z6GT	.96
FM-1000	1.28
UX120	1.38
UX200	1.28
9001	.89
9002	.39
9003	.69
9004	.49
9005	.98
9006	.49

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Our best wishes go to the "Voice of America" and all its personnel.

* * *

Club Notes

ENGLAND—Eric Good, Chief, *Swedish DX Fan Club,* 5, Aldred Street, Worksop, Notts., England, informs me that the club some weeks ago had 202 members in 13 countries; membership is *free* but an IRC for return postage should accompany application. This club will sponsor a special *DX* broadcast on December 13 from *Radio Saigon,* French Indo-China; exact time was not known when this was compiled, but details will be announced prior to the broadcast and will be given over *Radio Sweden* and possibly over *Radio Australia* also—during the weekly *DX* broadcast periods.

In the *SWBC* division of the contest just concluded by the *International Short Wave Club,* London, first place went to Glenn Richard, Sheboygan, Wisconsin, USA; in the amateur radio phone division, first place was awarded to T. E. Port, East Barnet, Herts., England.

* * *

This Month's Schedules

(*NOTE:* Some stations will have gone on Winter Time schedules between the time this was compiled and when you read it; in some cases, therefore, you may find *current* schedules are *one hour later* than listed herein. —KRB)

ALBANIA—GDX-aren, Sweden, reports *Radio Scutari* on 8.220 from 1400 with music.

ANDORRA—Radio Andorra, 5.976, heard best in New York around 1700-1800, fair signal; after 1800 has bad *QRM.* (Bellington, N. Y.)

ANGLO-EGYPTIAN SUDAN—Radio Omdurman, 9.747, has improved signal in the U. S. during daily all-Arabic beam 2315-2345. (Bellington, N. Y., others)

ANGOLA—CR6RL, 9.470V, usually has good signal from 1530 to 1600 which is normal sign-off; one day was on to 1825 with strong signal. (Bellington, N. Y.) *Radio Diamang,* 8.24, continues to come in well in South Africa 1330-1430. (Ridgeway)

AZORES—CS9MB, 11.090, Ponta Delgada, heard in Chicago 1400-1500; all-Portuguese; news in Portuguese 1430; opens and closes with series of two-toned chimes. Measured 11.089.12. (Grove, Ill.)

BECHUANALAND—Mafeking sent this data—Schedule is daily (*except* Sunday) 0600-0700, 1200-1430, and Sunday *only* 1300-1430; power 300 watts; frequency is 5.900; station is owned by the *Bechuanaland Protectorate Government;* musical programs are sponsored by *SABC;* the transmission 1200-1430 is heard well in South Africa; callsign is ZNB. (Ridgeway)

BRAZIL—PRL-8, 11.72, Rio de Janeiro, appeared recently to have changed its *"Hello, America"* program (Monday through Friday) to 2245-2300, but a report received at press time indicated it has either moved or discontinued the program.

ZYS-8, 4.805, Manaos, signs on 0500. (Cushen, N. Z.) First program is news in Portuguese.

BULGARIA—Radio Sofia, 7.671, has *English* broadcasts 1520-1530, 1645-1700. (Nordh, Sweden) Recently verified with card printed in *English,* evidently made up for *English*-speaking listeners. (Ferguson, N. C.) Has improved signal from opening around 2300. (Bellington, N. Y.)

CANARY ISLANDS—EA8AB, 7.520, Tenerife, heard 1630-1700 sign-off; announces sign-on for 0830; at closedown announcer says, *"Viva Franco!"* (McPheeters, N. Y.)

CEYLON—Radio Ceylon, 21.470, Colombo, heard in Australia 0500 with news, then music. (Sanderson)

CHINA—At the time this was compiled, a station on approximately 11.725 was being heard widely in the U. S. (by Balbi, Dilg in Calif.; Stark in Texas; Ferguson in N. C., and by myself in W. Va.), mornings, good signal with some *QRM* from U. S. station on 11.730. Has been heard signing off at 1000 on some days, and on others appears to run to around 1100. In the East it fades out around 0700 or a little later. Has been heard to announce calls of BED3 (*which is a m.w. outlet*) and BED9. Operates in dual

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417B	10CM 9.80	726A	10CM 4.75

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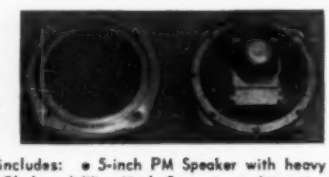

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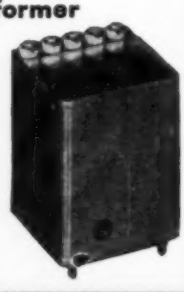

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with BED9 on 7.215; location is Taiwan, Formosa; *no English noted except an English lesson* at 0545 on Wednesdays (according to Stark). If not found on approximately 11.725, try approximately 11.680 which seems to be an alternate channel for the 25-m. outlet.

BCAF, Taiwan, Formosa, in verieletter stated power is 3.5kw.; transmitter is a Wilcox obtained from U. S. war surplus; scheduled on 11.680 (8.990 has been suspended) is 1700-1800, 2155-0000, 0330-0930; *English*-Chinese lesson at 0600 (this may be 0545-0600 on Wednesday *only*). (Cushen, N. Z.) This may be the transmitter now being heard in the U. S. on approximately 11.725.

At the time this was compiled, the Chinese outlet on 9.820 (listed Kweilin) was being heard with good level around 0900 on West Coast; appeared still in Nationalist control. (Dilg, Calif.)

Chungking has returned to Winter Time schedules. The 11.913 outlet appears to operate now around 0800-1145, with news 0900, 1100. (Fried, Mich., Dilg and Balbi, Calif.) The 15.170 channel should have news 0700 now but at the time this was compiled I had been unable to hear the 19-m. channel in several weeks. However, before Chungking went to winter schedules, the 15.17 outlet was being heard in Australia by Sanderson at 0430 with *English* and Chinese news.

Nanking, 9.73, and another Communist-controlled outlet on 9.74 (believed Hankow) have been heard as late as 1130. (Balbi, Calif.) The Communist-controlled station on 7.500 recently has had improved signal mornings; carries *English* relay from Peiping 0830. (Dilg, Calif.)

Nordh, Sweden, reports Nanking's BEA7, 11.832, heard with call, then Chinese news.

COLOMBIA—HJCF, 6.240, Bogota, *"La Voz de Bogota,"* heard recently 2200-2245 sign-off after playing *"Yankee Doodle"* and *Colombian National Anthem*. HJKJ, 6.160, Bogota, heard 2200-2300 sign-off; announces as *"Radio Cadena Nacional."* (McPheeters, N. Y.)

COSTA RICA—TIFC, 9.645, San Jose, noted with religious program in *English* 2345-2400; stated would return 1600; left air 0005; excellent level. (Bellington, N. Y.) Has Spanish and *English* programs daily 1600-2400 and appears to identify in *English* almost every 15 minutes; *QRA* announced *Radio Station TIFC*, P. O. Box 1307, San Jose, Costa Rica. (Leinbach, N. Y.) Slogan is *"Lighthouse of the Caribbean."* Promises to send souvenir to those who write in. (Smith, Ala., Balbi, Calif.)

CUBA—COCY, 11.74, Havana, when signing off 0100 has short announcement in *English* in which says purpose is *"to provide entertainment and improve Cuban broadcasting."* (McPheeters, N. Y.)

CURACAO—PJC-2, 5.010, heard with music 2205. (Hankins, Pa.)

CZECHOSLOVAKIA — OLR4B, 11.76, Prague, noted at good level 0120, signed off 0130. (Oskay, N. J., via NNRC) Heard in New York by McPheeters at 0100-0120 recently with news in Spanish at dictation speed, followed by propaganda speech (in Spanish) against Marshall Tito, and one entitled *"Franco in the Service of U. S. Imperialism."*

DENMARK—OZF, 9.52, Copenhagen, excellent daily, playing popular dance recordings in Danish, French, and *English* 1700-1730 sign-off. (Boice, Conn.) This is portion of the daily Home Service relay on this channel at 1240-1730. (*Radio Sweden*) Program for Far East over OZH, 15.165, is 0500-0600 on Tues., Thurs., Sat. *only*, news 0550; asks for reports. (Pearce, England)

DOMINICAN REPUBLIC — HI1N, 6.050, Ciudad Trujillo, noted with *English* lesson 1800-1818, powerful signal. (Lyttle, Ontario) This may not be a daily feature.

EGYPT—SUX, 7.862, Cairo, noted 1530 with usual Arabic program of music and news. (Sanderson, Australia)

ENGLAND—*BBC's* North American Service is now listed GSI, 15.26, 0600-0800; GSG, 17.79, 0800-0900; GST, 21.55, 0915-1215, 1300-1545; GSF, 15.14, 1445-1800; GWH, 11.80, 1700-2200; GRH, 9.825, 1800-2215, and especially for West Coast, GSF, 15.14, 1700-1845, GWH, 11.80, 1800-2100, and GSB, 9.51,

Here's What Dealer-Service Men Are Saying About The

RAYTHEON *Bonded* ELECTRONIC TECHNICIAN PLAN

HERE'S WHAT THE PLAN IS:

The dealer who displays this Certificate wipes out all doubt in his customers' minds as to the quality and dependability of his radio service work. He offers a 90-day BONDED guarantee on his radio set repair work and replacement parts, backed by *American Mutual Liability Insurance Co.*'s assets of close to a hundred million dollars. YET, IT COSTS HIM NOTHING!

Ninety per cent of all Raytheon Bonded Dealers report that they are making it the feature of their own advertising programs.

The *Raytheon* Tube Distributor in your area has this Bond for *you* — if you qualify. It doesn't cost you a cent, but at one fell swoop it sweeps away mistrust — the biggest barrier to volume and profit.

Get in touch with your *Raytheon* Distributor. Ask him how to become a BONDED ELECTRONIC TECHNICIAN.

RAYTHEON CATHODE RAY TUBES

Television Picture Tubes of genuine Raytheon quality are now available in all popular types. For peak video performance, specify Raytheon Radio and Television Tubes.

RAYTHEON

RAYTHEON MANUFACTURING COMPANY

NEW OFFERINGS THIS MONTH

EE-99 Telephone Repeater. For amplifier or telephony. Two audio amplifiers in one neat case, adjustable gain, adjustable equalization with 1000 cy. gain independent of equalizer setting.
A Steal at ONLY.....$7.95

COIL KIT: 125 all new coils! Contains IF cans, tuners, chokes, less than 2c per unit.
A real treasure chest for.....$2.19

JUST ARRIVED!

DZ-2 Navy Airborne Receiver for Ultrasonics, Range and Broadcast Band. Superhet, tunes 15 kc. through 1750 kc. Rewire the 6 v. tubes and apply standard recr. power supply.....$39.50

Scott Hi-Fi Output Transformer. Essentially flat 20-20,000 cy., 25 w., hermetically sealed. Impedance 5000 ohms pri., two CT secondaries 600 and 60 ohms, thus providing 150 and 15 ohm secondaries also.
NEW.....$1.80

HERE'S YOUR 500 OHM OUTPUT TRANSFORMER!
Secondary 8-10 ohms, tested at 10 watts; 3 DB at 15 kc, essentially flat 40-12,500 cycles.
NEW! ONLY.....$1.49

RG-8/U—NEW. Cut to order at $4.95 per 100 ft.
RG-7/U—NEW. Cut to order at $5.50 per 100 ft.

CITIZEN'S BAND IS LEGAL!

BC-645 Xmtr-Recr. 15 tube interrogator-receiver designed for airborne use, 460 to 490MC. With modification (instructions furnished) set can be used for 2 way communication, voice or code, on following bands: 420-450mc Ham; 450-460 mc, fixed and mobile; 460-470 mc. Citizens; 470-500 mc. TV experimental. Complete with all tubes, inc. WE doorknob tube. Size 10½x13½x4¾", wt. 25 lbs.
BRAND NEW.....$14.50
PE-101-C Dynamotor for above, 12 or 24 v.....$2.65
Extra Doorknob tubes, each.....39c

ATTENTION MARINE RADIOMEN!!!

Don't screw around with surplus! Your time is worth too much! Let us do it for you!
(1) G.L. "MARINER" RECVR., specify 12 or 24 v. DC. BFO ON-OFF, AVC-MVC, Long Wave, Broadcast, Marine, Short Wave. A beautiful conversion of a dog-gone good Navy surplus recvr., entirely new front panel, vernier on-the-nose resetting tuner, all controls on front panel, no plugs needed, ready to go. **$49.50**
(2) DU-1 Manual Direction Finder, specify 12 or 24 v. Converted for marine band, still retains half of Broadcast Band and all the lighthouse and beacon band. 2 tube pre-amplifier. No 180° ambiguity, true bearing immediately. Goes ahead of G.L. "Mariner" or any other receiver.....**Brand New $31.50**
(3) BC-223 TRANSMITTER. 15 watts, brand new. With used 12 v. dynamotor PE-55, connecting cable, 4 marine freq. xtals and mike.....**$89.50**

ASB-7 Transmitter. Light, neat airborne radar job with two trombone antenna tuners on front panel, high voltage condensers, blower, two 15E and one 15R tube. **SPECIAL, ONLY**.....$1.95

13 volt carbon-pile voltage regulator! **NEW**...$1.49

3 DIGIT resettable Veeder-Root counter with pilot lamp assembly, wafer switch, nice case. **New**...79c

Schmidt optical system for projection television, consisting of 12 in. mirror plus lens. **Brand New $16.50**

Modulator BC-456 used but excellent, with tubes and case, no corrosion, clean and sweet. **Only**.....$1.19

STROBOFLASH SPECIAL!

New professional unit. Complete with high output Amglo lamp, 5700° K, 1/2500 sec., 25,000 flash life, neat case, output cord to synch., adj. relay 10-35 milliseconds, 115 v. 60 cy. power input. You can't build the power supply alone for this price! **Only**.....$34.50

FL-8 Filters, laziest Q-5'er.....$1.79
2500 volt mica condenser, 750 mmf.....49c
15 assorted tube shields.....49c
3-gang BC condenser with removable 3 push-button assembly.....49c

BARGAINS ! ! !

See Page 182 Nov. Radio News for descriptions and knockout prices on the following:
Cathode Ray tubes, 5BP1.....$1.19
Also many other types.

Command Set units, racks, mounts.

The hottest 10 meter equipment in the land.

RA-34 Rectifier ready to go on 115 or 230 v. 60 cy. to give you 1000 volts DC!

Tuning units for BC-375 at only.....$1.95

RG-7/U coax, speakers, whip antennas.

Willard 2-V wet cell, new, 20-2.....98c

Metallic mine detector SCR-625 at **$39.50**

6 V. Dynamotor, 250 v. at 100 MA. **Only**...$2.65

Mobile vibropack PE-237, 6 v., 12 v., or 24 v. input to give 500 v. at 160 MA and other outputs at ridiculously low price.

Wanted! Your Spare Surplus Equipment and Tubes! Dynamotor, recrs., xmtrs, test equipment. Send list stating condition and your rock bottom price.

Remit with order. Calif. buyers add sales tax.

G. L. ELECTRONICS
1260 S. Alvarado St., Los Angeles 6, Cal.

SCHEMATICS—CONVERSIONS
FOR SURPLUS GEAR

PARTIAL LIST:

NEW BC-433-G Conversion $2.00
R-5/ARN-7 Conversion $2.00
ARC-4 schematic, parts, cabling.....$1.00
Another $2.00 for 2-meter AC conversion with all specs, tune-up, color-coded wiring diagrams.
BC-375-E original schematic, tuning units, complete parts list, values, characteristics, circuit functions, plate and ant. currents..$2.00
BC-645 original and conversion.....$1.00
ARC-5 schematics, all units.....$2.00
SCR-522-A, AM, and C schematics, parts lists with circuit functions, explanation of differences, chart for xtal selection.....$2.00

Please remit with order. We pay postage. Send 25c and stamped addressed envelope for comprehensive list, cross-indexed for BC and SCR. Includes chart explaining code used in Army-Navy nomenclature.

R. E. GOODHEART
345½ N. PALM DRIVE
BEVERLY HILLS, CALIF.

2100-2215; among important items are program preview 1615; *Radio Newsreel* 1800 and 1900 (repeat); news 2000 followed by *Home News From Britain* at 2010; news 2200 followed by *From the Editorials*.

FRANCE—Worris, N. Y., sends along these complete schedules of Paris transmissions. *Radiodiffusion Francaise* is currently using 6.200, 7.240, 7.280, 9.550, 9.560, 9.680, 11.700, 11.845, 11.886, 15.240, 17.850, and 21.740. Schedules include 1900-2030 on 9.560 for the Antilles, Guiana, and St. Pierre and Miquelon Is. in French; 1915-1930 on 9.550 for Latin America in French; 1830-1845 on 9.550 and 11.700 for North America in French (not in effect when this was compiled; may be broadcast one hour later); 1845-1900 on 9.550 and 11.700 for North America in *English* (at the time this was compiled, this period was one hour later—1945-2000); 2300-2315 on 11.886 for Madagascar, Reunion, Commores Is., and the French Somali Coast in French; 0000-0015 on 9.550 and 6.200 for North Africa in French (*not* Sunday); 0030-0130 on 9.550 for the Pacific (Tahiti, New Caledonia, New Hebrides, Marquesas Is., and Wallis and Fortuna Is.) in French; 0145-0245 on 17.850 and 15.240 for Equatorial Africa and the French West Coast in French; 0200-0303 on 6.200, Paris-International; 0615-0630 on 15.240 for the Middle East in Arabic; 0630-0645 on 15.240 for Greece in Greek; 0700-0715 on 15.240 for North Africa in Arabic; 0830-1030 on 17.850 for Indo-China in French and Annamese; 1045-1100 on 21.740 for Brazzaville in French (Tues., Wed., Fri., Sat. *only*); 1115-1215 on 15.350 for Madagascar, Reunion, Commores Is., and the French Somali Coast in French; 1115-1200 on 9.560 for the Middle East in Arabic; 1200-1230 on 11.845 for the Danube Balkans in French; 1215-1230 on 9.560 in Esperanto; 1230-1245 on 9.550 for Finland in Finnish; 1230-1300 on 7.280 for Czechoslovakia in Czech; 1245-1330 on 9.560 for Yugoslavia in Yugoslavian; 1300-1330 on 7.280 for Roumania in Roumanian; 1330-1345 on 7.280 for Italy in Italian; 1330-1400 on 9.560 for Bulgaria in Bulgarian; 1330-1400 on 9.680 for North Africa in French; 1345-1400 on 7.280 for Czechoslovakia in Czech; 1400-1430 on 11.845 for the Middle East in French; 1400-1430 on 7.280 for Poland in Polish; 1415-1500 on 7.240 for North Africa in Arabic; 1430-1500 on 7.280 for Hungary in Hungarian; 1500-1530 on 7.280 for Portugal in Portuguese; 1500-1700 on 6.200, Paris-International; 1445-1515 on 9.560 for Spain in Spanish; 1515-1645 on 11.845 and 15.240 for Equatorial Africa and the French West Coast in French; 1830-1835 on 9.550 for Latin America in Spanish. *The North American daily service should have been lengthened by this time or will be early in the New Year.*

FRENCH CAMEROONS—Douala, approximately 9.160, heard daily now in Newfoundland 1430-1530. (Peddle)

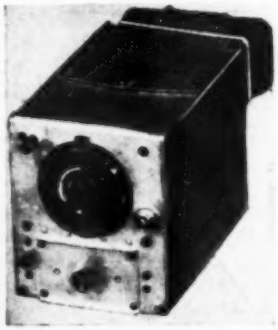
FRENCH EQUATORIAL AFRICA—Radio Brazzaville announces that its *Mailbag Program* is now on Sunday instead of Saturday—on one of the news bulletins which are scheduled 1045, 1345, 1745, 1900 (probably is heard around 1900). (Lyttle, Ontario)

Examining the new revolutionary all-glass rectangular television bulb are Dr. Harvard B. Vincent, Director of Product Development, and Kenneth M. Henry, Vice President and Chief Engineer of American Structural Products Company. The new rectangular bulb will give television tube manufacturers an ideal all-glass bulb designed to receive one hundred per-cent of the transmitted television picture. The new bulb will also make possible smaller television set cabinets without reducing the size of the picture. Made automatically, it is no more costly than a comparably sized round bulb and is exactly designed to receive the shape of the transmitted picture. Production lines already have been established by American Structural Products Company, a subsidiary of Owens-Illinois Glass Company.

Timely Bi-Monthly BARGAIN BULLETIN

! FREE !

Now you can get the latest, lowest prices on practically anything you need in standard and surplus radio and TV equipment. Just drop us a card to get the Bargain Bulletin regularly. MONEY-BACK GUARANTEE on everything! You can depend on R & M to send you what you want . . . when you want it!



ORIGINAL LAZY Q FIVER

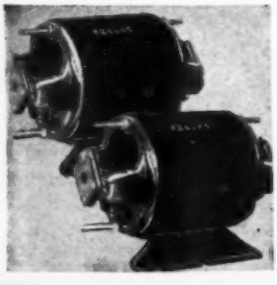
BC-453 reduced from $16.95 to
Limited Quantity
None to Dealers **$9.95**

Proclaimed "best buy" by Hams from coast to coast—190-550 KC (Lazy Q Fiver).

FOR PERFECT SINGLE SIGNAL RECEPTION

Says JAN. QST (p. 40, Tech Topics): . . . "(BC-453A) will perk up that old broadband superhet of yours and make it cut through the QRM and pull out the desired signal like nothing you ever saw or heard." BC-455 is easily adapted to 10 to 20 meters. Then all you need is one BC-454 to cover 75 meters and you cover most of the Ham bands. Order yours today!

BC-454, 75 Meters.....$6.95
BC-455, 10 & 20 Meters.....$6.95



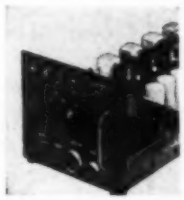
Save your batteries with 6-VOLT DYNAMOTORS

DUAL POWER SUPPLY **$4.95** each — ***Both for $8.95***

Low: 300 v. at 24 watts; high: 600 v. at 48 watts. Shipping weight 7 lbs.

160 METER BAND FOR PERFECT SIGNALS

— Your chance to get away from crowded traffic! —

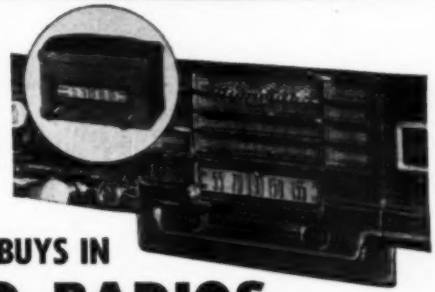


160-METER RECEIVER

Hi-voltage power supply, 110 VAC, 60 cycle-operation
War-surplus item disappearing fast
Buy now or never for just **$14.95**

4 channels on 160 meters . . . Select your day-and-nite freqs. by easy switching; 150 mil, 300 VDC .01% regulated power supply; two hi-voltage supplies, each 1350 VDC 2 mils; converts in 45 minutes. By presetting the 4 channels you're prepared to receive on the old favorite 160 meters. Moreover, you'll have a power supply from 200 to 325 VDC at 150 Ma, continuously variable, with extremely low ripple content, .01% voltage regulation electronic controlled. Conversion is simple—consists of adding a pot for receiver gain control, a small audio output transformer and one half-watt resistor. Complete, simple instructions furnished with each set. Shipping wt. 33 lbs.

Enjoy Music While You Drive

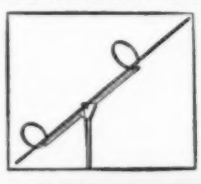


TERRIFIC BUYS IN AUTO RADIOS

- Custom-built for Plymouth and Dodge, 1949's and 1950's; built-in speaker. 6 tubes, with one stage of RF. Super volume **$27.97**
- Custom-built for Fords, 1949's and 1950's, as above with separate speaker **$27.97**
- For any make auto or truck; under-dash mount, as above **$25.97**

OUTSTANDING ENGINEERING MAKES THIS MODEL THE LEADER IN ITS FIELD

ALLWAVE TELEVISION FM ANTENNA



$13.25 VALUE, SPECIALLY PRICED AT **$6.49**
Add 75c for shipping & handling

Full coverage of both TV and FM bands; reduces noise to a minimum; designed to match all sets with the standard 300 ohm input. Easy to install—anyone can erect the antenna. All aluminum.

TERMS: F. O. B.
Under $10—cash with order.
Over $10—25% deposit; balance C.O.D.

R&M RADIO COMPANY

2701 WILSON BLVD. • DEPT. RN 12 • ARLINGTON, VIRGINIA

NEW TELEKITS NOW 49.95

Jobbers: Write for Confidential Price Information

NEW TELEKITS
10-B $69.95
7-B $49.95
Less Tubes

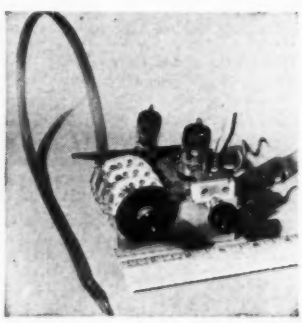
Sparkling new Telekit 10-B has 52-inch screen. Brand new compact lay-out has video tube mounted on chassis. Big illustrated easy-to-follow instruction book guides you step by step through easy assembly. No special knowledge of television is required. All you need is a soldering iron, pliers, and screw driver. 10-B kit can be used with 12½, 15, 16 inch tubes. Telekit 10-B, $69.95. 10-B Telekit cabinet $15.95 and $24.50. Satisfactory Telekit performance guaranteed by Factory Service Plan.

Write for catalog listing 10-B and 7-B Telekits. New 7-B Telekit for 7-inch tube, $49.95. 7-B cabinet, $15.95 and $24.50.

TELEKIT BOOSTER 12.95

This Telekit booster will bring in TV signals bright and clear in the fringe areas. Has a 20 times boost on all TV channels. NOT A KIT. Completely assembled. With tubes. Works with Telekit or any TV receiver.

13 CHANNEL TUNER 12.95



This compact front end has a stage of RF for extra distance. Made to conform with Telekit or any TV set having a video I.F. of 25.75 Mc. Complete with tubes, pre-wired, pre-assembled. Only four connections to make.

Write for catalog of Telekit antennas, boosters, television kits tuners, television parts and tubes.

TELEKIT
ELECTRO-TECHNICAL INDUSTRIES
1432 NORTH BROAD STREET PHILADELPHIA 21, PA

FRENCH INDO-CHINA—Radio Saigon, 11.78, noted 0530-0600 in native but identified in French 0545. (McPheeters, N. Y.) Has been heard here in West Virginia as late as 1000, weak; should have *English* around 0830-0930.

The 6.165 channel heard with French news 0930, considerable *QRM.* (Treibel, Washington State, via URDXC)

FRENCH MOROCCO—Radio Maroc, Rabat, says it is operating on 6.006 with 2.5kw.; scheduled daily 0145-0330, 0600-0930, 1300-1830 in French, Arabic, Spanish. (Radio Sweden)

GERMANY—Leipzig, approximately 9.729, recently was fair signal in Calif., clear of Nanking's 9.732, around 1000. (Dilg) Heard in New York as late as 1900. (Schild) In East has bad *QRM* from around 1700.

The *new* 100kw. Berlin-RIAS transmitter is on m.w., *not* on s.w.

GOLD COAST—According to a Leopoldville, Belgian Congo, *DX* broadcast, Accra is scheduled on 9.640, 5kw., 0430-0530, and the 4.915, 1.8kw., outlet is scheduled 0928-1155; may be in parallel; reports requested to Senior Programs Officer, Box 745, Accra, Gold Coast. The information was received by Leopoldville direct from the station. (Grove, Ill.) The 9.640 outlet is listed 5kw. and as "inactive." *Does anyone hear this one, and at what time?*

GREECE—An airmail verification from the *Radio Broadcasting Station of the Greek Army,* Central Greece, Larissa, states the station operates with 500 watts for troop entertainment; frequency is 6.745 and schedule is 2330-0130, 0430-0730, 1200-1600; formerly was Army Corp outlet; has discontinued news in *English* 1530 due to technical reasons—but was to resume it shortly, probably by now. (Cushen, N. Z.)

Radio Athens, 9.60, heard opening 0000 with strong signal; *no English noted;* the 15.345 channel heard 1030 with Greek at dictation speed. (Fargo, Ga.) This outlet heard in West Virginia 1045 with news.

HONG KONG—ZBW3, 9.525, heard in Calif. 0815-0915; 0815-0830 has news or music; 0830-0915 popular recorded music; station breaks given every 15 minutes, *"This is Radio Hong Kong;"* weak signal. (McPhadden)

HUNGARY—Budapest, 6.247, heard in Australia 1545 with news from *Pravda* on Poland and Czechoslovakia, then music. (Sanderson)

The station wrote Patrick, England —"Our former short-wave station was destroyed by Nazis and its equipment pillaged. Building and transmitters are located at Diasd near Budapest for the construction of a *new* 100kw. station to be put into operation on April 15, 1950." By now was to have increased power to 2kw. on 6.247, 9.820, with a daily schedule of 0800-1740.

INDIA—AIR, 11.710, is good level in New York around 1430-1500, in *English.* (McPheeters)

Current schedules received via airmail are:

DELHI—VUD2, 10kw., 7.290, 2130-2330; 9.630, 0200-0400; 7.290, 0630-0800; 4.960, 0815-1230. VUD3, 5kw., 15.290, 2030-2145; 9.680, 2200-2230; 15.290, 0200-0240; 17.760, 0300-0400; 17.830, 0730-0750; 15.290, 0830-1100; 9.590, 1130-1230. VUD4, 10kw., 11.850, 2030-2230, 0200-0400, 0730-0750, 0830-1100, 1130-1230. VUD5, 100kw., 15.190, 2030-2200; 15.160, 2300-2330; 21.510, 0230-0330, 0600-0815; 17.840, 0830-0915, 1000-1040; 15.170, 1100-1230; 11.710, 1400-1500; 17.840, 1930-2015. VUD7, 100kw., 11.790, 2030-2115, 2130-2200; 9.565, 2215-2310; 17.830, 0230-0330; 15.160, 0430-0530, 0615-0730; 9.590, 0745-1045; 11.790, 1110-1330; 9.620, 1400-1500; 11.850, 1845-1900, 1945-2000. VUD8, 7.5kw., 11.870, 2030-2115; 7.275, 2130-2215; 11.830, 0220-0250; 0310-0320, 0340-0350, 0700-0750, 0830-0915; 7.275, 0945-1100, 1110-1330. VUD9, 7.5kw., 9.680, 2030-2115; 9.660, 2145-2230; 15.350, 0220-0250; 9.680, 0310-0320, 0340-0350, 0700-0750, 0830-0915; 6.010, 0945-1100, 1110-1330. VUD10, 20kw., 15.160, 2030-2115, 2130-2200; 7.225, 2215-2310; 17.780, 0230-0330; 17.840, 0430-0530, 0615-0730; 7.255, 0745-1045; 15.290, 1110-1330; 7.240, 1400-1500; 15.290, 1845-1900, 1945-2000. VUD11, 20kw., 9.630, 2030-2200; 17.780, 2300-2330; 15.190, 0230-0330; 17.780, 0600-0815; 15.190, 0830-0915, 1000-1040; 17.760, 1100-1230; 11.760, 1400-1500; 15.130, 1930-2015.

BOMBAY—VUB2, 10kw., 7.240, 2100-2330; 9.550, 0215-0400; 7.240, 0630-0845; 4.840, 0900-1230. VUB3, 0.25kw., 9.550, 2100-2330; 7.240, 0215-0400; 9.550, 0630-0845; 7.240, 0900-1230.

CALCUTTA—VUC2, 10kw., 7.210, 2030-2230; 9.530, 0200-0430; 7.210, 0600-0800; 4.880, 0815-1200. VUC3, 0.25kw., 9.530, 2030-2230; 7.210, 0200-0430; 9.530, 0600-0800; 7.210, 0815-1200.

MADRAS—VUM2, 10kw., 7.260, 2030-2230; 9.590, 0200-0430, 0530-0630; 4.920, 0700-1200. VUM3, 0.25kw., 9.590, 2030-2230; 7.260, 0200-0430, 0530-0630, 0700-1200.

INDONESIA—YCN-3, 8.090, Pontianak, Dutch Borneo, heard now 0545-1000 sign-off. (Balbi, Calif.)

At the time this was compiled, Batavia's new 100kw. transmitter was not on the air as had been promised by station officials. However, by the time you read this it may have taken to the airwaves; continue to watch for it over *YDC,* 15.15, 0600-0700 in *English* period.

Bandoeng, Java, heard recently, mornings, on approximately 10.070 (Dilg, Calif.)

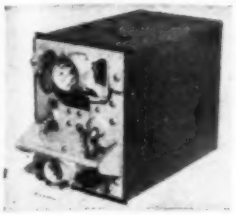
IRAN—At the time this was compiled, Teheran, 15.100, appeared to have changed its daily *English* news period to 1355; signs off 1500. (Pearce, England, others)

IRELAND—Radio Eirrean's new 100kw. transmitter should be on the air by this time; most likely channels are 17.840 and/or 9.595. (Patrick, England)

ISRAEL—Tel-Aviv has been moving about a great deal; reported opening 2245 on such frequencies as 6.830, 9.000, 15.700, 11.935.

In confirming my reception of the

Here's A REAL BUY For $5.00!



PERMANENT MAGNET FIELD DYNAMOTORS —POWER SUPPLY

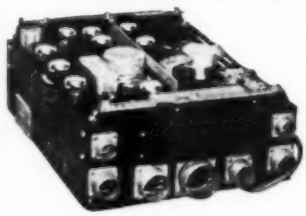
POWER SUPPLY: 12 or 24 Volt DC input; output 275 Volt 110 MA.; 500 Volt 50 MA. Completely filtered and housed in metal case. These units were originally used with Mark II No. 19 radio sets and cost Govt. $150.00. The dynamotors will operate on 6 VDC at approx. half the voltage, thereby giving you a good motor for car shaver or AC-DC radio operation, and a power supply for your mobile receiver from your 6 Volt auto battery. This power supply unit contains all of the items pictured and described in the column to the right. Size: 8" H x 6" W x 10" D. Shipping Weight: 62 lbs.

Complete Unit—Order No. RPS #3 ..... $5.00

EACH UNIT CONTAINS THE FOLLOWING PARTS WHICH MAY BE PURCHASED SEPARATELY:

1—Dyn. 12/24 input; output 275 V 110 MA.	$3.95
1—Dyn. 12/24 input; output 500 V 50 MA.	2.95
8—.1 500 V Oil Tubular Cond.	1.00
2—.1 1000 V Oil Tubular Cond.	.50
2—15 MFD. 400 V DC Elect. Cond.	.80
1—DPST 15 A. Toggle Switch.	.40
1—3PDT 20 A. Toggle Switch.	1.00
2—Fuses—Holders & ¼ A. Fuses.	.30
1—Pilot Light 12 V & Holder.	.20
5—Filament & RF Chokes.	1.00
1—Spare Brush Kit.	1.00
Also—Resistors, Plugs, Panel Chassis, Cable, Case, and Grill.	3.00

BC-645-A TRANSCEIVER For Citizens Band



• 15 Tube Transceiver ideal for conversion to 460 MC Citizens Band. Frequency coverage 435 to 500 MC Complete conversion instructions for Citizens Band furnished. Price, NEW and BOXED. **$16.95**

DYNAMOTOR PE-101 for BC-645-A—13 or 26 volt input; required voltage output. $2.95

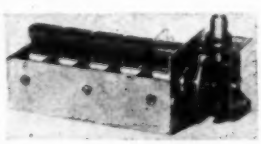
TRANSFORMER for BC-645-A—110 volt 60 cycle input; output 400 volt 150 MA after filter. 12, 9, and 6 V. AC. 4 amps. and 5 V. 3 amps. No. NH-645. ..... $6.95

CHOKE—15 Hy. 150 MA. No. NH-646. ..... $2.95

TRANSFORMERS—110 Volt

60 Cycle Primaries:

Sec. 12 V. 1 amp.	$1.50
Sec. 24 V. 1 amp.	1.95
Sec. 24 V. 2 amps.	2.25
Sec. 24 V. .5 amp.	1.50
Sec. 36 VAC. 2.5 amps.	2.95
Sec. 14-14 or 28 V. 7½ or 15 amps	4.95

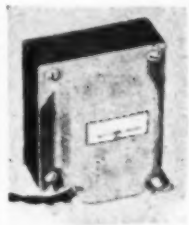


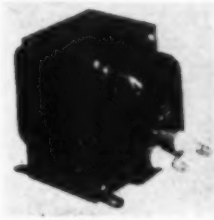
CONDENSER ASS'Y.

5 GANG with vernier tuning. 25 MMFD. to 450 MMFD. each section. Size: 7⅛"x3½"x3½". Price $2.95

CONDENSER—3 Gang, 25 MMFD. to 450 MMFD. ea. section. Size: 6"x3¼"x3". Price $1.95

NEW TRANSFORMERS And CHOKES





ALL FOLLOWING TRANSFORMERS 115 V.A.C. 60 CYCLE INPUT:

OUTPUT: 750-0-750 V.A.C. (600 V.D.C. after choke input filter at 250 MA.) Includes 6.3 V.A.C. winding at 5 amps and 5.0 V.A.C. winding at 4 amps. NH-106 ..... **$7.95**

OUTPUT: 625-0-625 V.A.C. (500 V.D.C. after choke input filter at 250 MA.) Includes 6.3 V.A.C. winding at 5 amps and 5.0 V.A.C. winding at 4 amps. NH-107 ..... **$7.35**

OUTPUT: 600-0-600 V.A.C. at 250 MA. 12 V.A.C. at 3 amps; 12 V.A.C. at 3 amps and 5 V.A.C. at 3 amps. Designed for Army surplus transmitters. NH-108 ..... **$6.90**

OUTPUT: 250-0-250 V.A.C. at 60 MA. 24 V.A.C. at .6 amps; 6.3 V.A.C. at .6 amps. Designed for Army surplus Receivers. NH-109. ..... **$3.00**

OUTPUT: 6.3 V.A.C. at 6 amps. NH-110. ... **$2.25**

OUTPUT: 24 V.A.C. at 2 amps. NH-111. ... **$2.25**

OUTPUT: 2.5 V.A.C. at 10 amps. center tapped and shielded. Open frame mounting insulated for continuous operation at 5,000 volts. NH-113. ... **$4.20**

(ALL TRANSFORMERS ARE CASED)

CHOKES:

NH-115—8 Henries at 500 MA. filter choke, 5,000 volt insulation **$9.95**

NH-116—5-20 Henry 500 MA. swinging choke, 5,000 volt insulation **$9.95**

NH-117—8 Henries at 700 MA. filter choke, 7,500 volt insulation **$14.95**

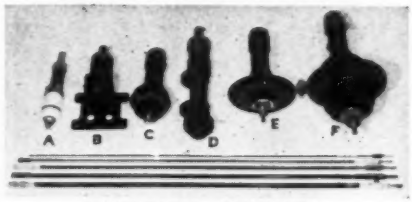
NH-118—5-20 Henries at 700 MA. swinging choke, 7,500 volt insulation. **$14.95**

NH-121—15 Henries at 250 MA. filter choke, 1,500 volt insulation. **$4.95**

(ALL CHOKES ARE CASED)

ALL ABOVE ITEMS BRAND NEW—NOT SURPLUS!

WHIP ANTENNA EQUIPMENT



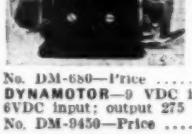
MAST BASES—INSULATED:

A.	MP-132—1" heavy coil spring, 2" insulator, overall length: 11½". Wt.: 2¾ lbs. Price:	$3.95
B.	MP-22—Spring action direction of bracket. 4" x 6" mounting. Price:	2.95
C.	MP-57—2" heavy coil spring, 5" insulator.	3.95
D.	MP-48—2" heavy coil spring, 3" insulator.	2.95
E.	MP-37—2" heavy coil spring, 8" insulator.	3.95
F.	MP-47—2" heavy coil spring, 9" insulator.	5.95

MAST SECTIONS FOR ABOVE BASES:

Tubular steel, copper coated, painted, 3 foot sections, screw-in type. MS-53 can be used to make any length, with MS-52-51-50-49 for taper. Price—any section ..... **50c** Ea.

CANVAS BAG BG-56 for carrying above mast sections. Price, Ea. **50c**



MOBILE DYNAMOTOR

680 Volts 210 MA. output at 12 V AC input. 6VDC input; 300 Volt 150 MA output. As illustrated. Size: 7" x 4".

No. DM-680—Price **$7.95**

DYNAMOTOR—9 VDC input; output 450 V. 60 MA. 6VDC input; output 275 V. 50 MA. with Blower.

No. DM-9450—Price **$3.95**

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Ideal as radio beam position indicator for Ham, Television, or Commercial use. Complete with 5 inch 1-82 Indicator, Autosyn Trans., 12 Volt 60 cycle Transformer, and wiring instructions.

Prices: NEW .... $9.95 USED **$7.95**

PL-118 PLUG f/1-82: ..... $1.00 Autosyn Trans.: ... $2.95

COMMAND RECEIVERS—TRANSMITTERS—And Accessories:

	USED:	NEW:
BC-453 Receiver, 190-550 KC.	$12.95	
BC-455 Receiver, 6—9.1 MC.	7.95	
BC-454 Receiver, 3—6 MC.	6.95	
DUAL or TRIPLE RECEIVER RACK.	1.50	
BC-450 Triple Con. Box.	1.95	
TRANSFORMER—F/Comm. Rec.—110 V. 60 cycle input; output 250-0-250 VAC. 60 MA.; 24 VAC. .6 A. & 6.3 VAC. .6 A. No. NH-109—NEW.	3.00	
DYNAMOTOR—Can be used on 6 VDC. to supply 240 V. 50 MA. F/Comm. Rec. Mobile operation. USA/0515—Price.	2.95	
BC-459 Transmitter 7—9 MC.	$12.95	
BC-457 Transmitter 4—5.3 MC.	7.95	$ 9.95
BC-458 Transmitter 5.3—7 Mc.	5.95	8.95
T-18 Transmitter 2.1—3 MC.	8.95	
T-20 Transmitter 4—5.3 MC.		9.95
T-23 Transmitter 100-156 MC.		29.95
DUAL TRANSMITTER RACK.		1.50
BC-451 Trans. Control Box.		1.50
BC-442 Antenna Relay Box with Cond.		2.95
BC-456 Transmitter Modulator Re-issue.		2.50
TRANSFORMER—F/Comm. Trans.—110 V. 60 cycle input; output 600-0-600 VAC. 250 MA.; 12 VAC. 3 A. & 12 VAC. 3 A. & 5 VAC. 3 A. NH-108.		$6.90
CHOKE—15 Hy., 250 MA. No. NH-121.		4.95

MISCELLANEOUS:

MARK II No. 19 Transmitter & Receiver 15 Tube Set, complete with operating equipment. Prices: USED. ..... $39.50 NEW. $59.50

FL-8A FILTER—1200 CPS. $1.95

SELSYNS 2J1G1 with Caps and instructions. Pair $3.00

SELSYNS 2V C-78248—110 V. 60 cycle & instr. Pair $5.95

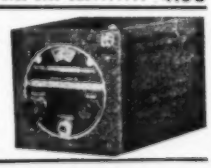
FT-237 MOUNTING BASE f/BC-604 & 603's, & f/BC-684 & 683's. Prices: NEW. ... $9.95 USED. ... $7.00

BLOWER—110 Volt 60 cycle, 4" intake, 2" outlet. Approx. 100 cu. ft. dis. Motor size: 3"x3", 1750 RPM. Prices: NEW. ... $6.95 Motor Only. ... $3.95

CO-213 CABLE—Seven conductor No. 20 AWG., with 2 cond. separately shielded within the outer shield for all 7 conductors. Insulated, rubber covered, 35 ft. length $1.25

RG-8U Coaxial Cable. Per Ft.	.05
Cable—4 Conductor, shielded, 50 Ft. length.	2.00
Coaxial Cable—125 OHM cotton covered, 50 Ft.	1.00
CABLE CD—280 one #6 wire, shielded RC 15 ft.	1.00
CABLE—2 #16 wire, rubber covered—20 ft.	1.00
Cable f/BC-375 w/PL-59 ea. end.	1.75
Cable f/BC-375 w/PL-61 ea. end.	1.75
Cable f/BC-375 w/PL-64 ea. end.	1.75
Tuning Unit f/BC-375 TU-6-8-10-20. Each	3.95
FT-151 Mounting f/BC-375-191	1.50
GN-45 Generator	3.00
Leg & Seat Ass'y. f/hand generators.	2.75
Crank for hand generators. Each	.75
BC-357 Marker Beacon (used).	2.95
BC-301 Marker Beacon, less tube.	1.95
BC-347 Amplifier, Used, less tube.	.79
BC-709 Amplifier—with Tube, less battery.	4.95
HS-17 Head Phone & Chest Set used w/EE-8 for extensions. Prices: NEW $3.95; USED	2.95
HS-33 Headset, Low imp. (used).	1.25
TS-13 Handset	3.95
T-17 Microphone. USED: 98c; NEW	1.49

BC-1206 RECEIVER
SETCHELL-CARLSON



200—400 KC. 5 Tubes. Operates from 24-28 Volt DC. IF Freq. 135 KC. Size: 4" x 4" x 6". Price: LN **$7.95**

BC-223 TRANSMITTER

30 Watt Transmitter with crystal oscillator control on four preselected channels—also master oscillator. Frequency coverage 2000 KC. to 5250 KC. by use of three plug in coils. Five tube operation, 801 oscillator, 801 power amplifier, two 46 modulators, and one 46 speech amplifier. Price with TU-17 Tuning Unit, 2000 to 3000 KC. and cable from transmitter to dynamotor.

Prices: NEW ..... $24.95 USED **$19.95**

ADDITIONAL TUNING UNITS:	NEW:	USED:
TU-17 2000 to 3000 kC.	$3.50	$2.50
TU-18 3000 to 4500 KC.	3.50	2.50
TU-25 4500 to 5200 KC.	3.50	2.50

CABLE only for Transmitter to Power Supply for BC-223 Transmitter. Price **$1.75**

PE-125 POWER SUPPLY for BC-223 Transmitter. Operates from 12 or 24 Volts and supplies 500 volts at 150 MA. Prices: NEW. ... $9.95 USED ... **$7.95**

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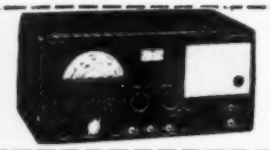

MEDIUM PRICED HALLICRAFTERS MODEL S-40A

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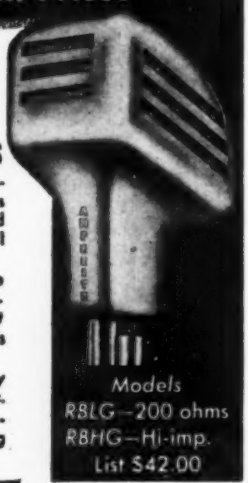

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RM-4 RECORDING MOTOR (G.I.) . . Adaptable to 33⅓ or 78 RPM. Silent operating for WIRE, TAPE, or DISC RECORDING—PLAYBACK. 110V, AC. 3⅜" sq. x 2¾". Less turntable, mtg. plate & drive wheel. Shpg. wt. 6 lbs. **$4.95**

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4-TUBE AMPLIFIER FOUNDATION . . Black crackle cabinet & slide-in chassis & panel. Contains: Power trans., condensers, resistors, sockets, etc. 8¼"x 4½"x3¾". Shpg. wt. 4 lbs. **95c**

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9.000 outlet, a *Kol-Yisrael* official stated the transmitter on that channel is a 7.5kw. RCA ET-4750, working into a semi-directional dipole, which was to be replaced by a rhombic directed to Western Europe and Eastern U. S. Said, "Kol-Yisrael may use any of these test frequencies—11.935, 15.415, 17.880, 21.465. At present these transmissions are in the experimental stage and a fixed schedule of programs cannot be issued. The inauguration of an Overseas Service is planned. Programs will be beamed on New York, and a great part of same will be in the *English* language. Initially, there will be daily programs in Hebrew, Yiddish, *English,* and French—as well as an extension of the existing programs for the Middle East in Arabic, Turkish, and Persian between 2245-1530." He promised to keep me informed.

JAMAICA—ZQI, 3.480, Kingston, fine level nightly from 1930. (Balfe, Mass.)

JAPAN—Kure, 6.105, heard relaying Australia 0705. (Stark, Texas) Good in California to 0830 sign-off. (Dilg) JKH, 7.257, Yamata, fair 0620; JKJ, 7.285, Nazaki, fair 0600. (Oskay, N. J., via NNRC) JKL-2, 9.605, Tokyo, *AFRS* outlet, noted 0300 with news, good level, but rapid fade; 0315 announced *"This is the Far East Network."* (Bellington, N. Y.)

KENYA COLONY—The Nairobi station writes—"Our transmissions take place on 857kcs. and 4.885 simultaneously Monday to Friday 0500-0600 and 1000-1400; Saturdays 0500-0610 and 1000-1500. This latter transmission is extended to 1500 also on Wednesday. *QRA* is P.O. Box 777, Nairobi, Kenya." (Radio Sweden) Heard in New Zealand on Saturday to closing 1500, when announced *"This is Nairobi Radio."* (Clark)

LEBANON—Radio Beirut, 8.036, heard 1545 with musical program and French news. (Sanderson, Australia) Heard in England recently 1110-1115 in *English;* is likely the *English* period now begins 1100. (Pearce) *Radio Sweden* lists schedule of 0000-0130, 0530-0830, 1000-1630; says sends verification card by registered airmail.

LUXEMBOURG—New schedule of *Radio Luxembourg,* 6.090, appears to be 1300-1800. Now has *English* on Sundays 1515-1800 and weekdays 1630-1800; soon will send out *QSL* cards which are being printed in London; all reception reports and comments are always welcomed by Radio Luxembourg, 36, Davies St., London, W.1, England; reports are then forwarded to engineers at *Radio Luxembourg,* but are answered from the London office due to shortage of personnel at Luxembourg. (Patrick, England) The 6.090 outlet is reported to run to 1900 on Saturday. The 15.350 channel is scheduled 0600-0830. (Radio Sweden)

MADAGASCAR — Tananarive has what seems to be a test transmission on approximately 5.39 at 1100; is special program, not in parallel with other transmitters; good signal in South Africa. (Ridgeway) Not listed.

Kuala Lumpur, 6.025, still noted 0630 with news. (Stark, Texas)

Radio Malaya's new Blue Network outlet in Singapore, 9.712, opens 0530 with program schedule; runs 0530-

(*Continued on page* 137)

Photometer

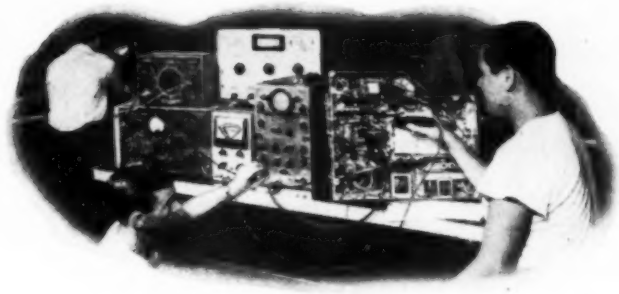
(*Continued from page* 39)

tivity is desired, phototubes may be used in parallel, achieving twice the sensitivity for two tubes, three times for three, and so on. This has the advantage that it does not greatly increase battery drain or circuit complexity as would occur with the addition of another stage of direct current amplification.

Two other factors determining the sensitivity of the instrument are the phototube load resistance and the effective transconductance of the v.t.v.m. tube. In the first instance, one microampere of current developed across one megohm will produce a voltage drop of one volt, while the same current across ten megohms will equal ten volts. Assuming an effective transconductance of 1000 micromhos, or one milliamp per volt, an effective current amplification to 10,000 may be achieved. Increasing the value of load resistance above ten megohms gives a rise in sensitivity but introduces problems of instability due to grid current and change of resistance caused by moisture and dust. The relationship between gain and load resistance may be used as the basis of a simple switching arrangement for different light intensity ranges, as is shown in the schematic where switching between a load of one megohm and ten megohms gives a sensitivity ratio of ten to one. In cases where it is desired to use the instrument in fairly bright illumination, perhaps outdoors, it is preferable to use a conventional voltage divider arrangement to prevent excessive current from flowing through the tube. Less convenient but still desirable is the use of cardboard masks to cut down the intensity of the light falling on the phototube. This has the advantage that the tube is operating over the same portion of its curve all of the time, and possible errors due to saturation are eliminated.

Although the unit is somewhat bulky in comparison to commercial pocket-size exposure meters, the over-all dimensions may be reduced to a comparable size through the use of such subminiature components as hearing aid tubes and batteries and miniature phototubes like the 934. Principal drawbacks are lowered battery life and decreased sensitivity due to the lower area of the small phototube.

Construction is simple and uncritical as shown by the photographs, and the mechanical layout may be adapted to the builder's requirements. Although a 200 microamp meter is used in the instrument shown, meters up to one mil will operate satisfactorily. In the



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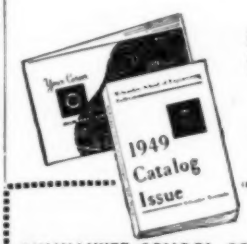

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8 Henry 150 MA 195 Ohms .97 each

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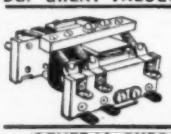

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event it is desired to use an extension photocell like the one shown in the photograph, it would be wise to use shielded cable to prevent pickup of stray a.c. voltages. If two-conductor cable is not available, the shield may be connected to "B+," taking care to prevent possible short circuits.

Numerous applications suggest themselves for a device of this kind. First, of course, is its use as an exposure meter. Due to the wide range of sensitivity available, the photometer may be used thus for time exposures under poor lighting conditions and ought to be particularly useful in color photography. Calibration may be easily made through comparison with a standard exposure meter on one of the low sensitivity ranges and the readings multiplied on the other ranges.

The considerable sensitivity available makes this device an excellent companion to the well-known dark room phototimer. In this application the meter is used to determine the amount of light falling on an enlarger easel or penetrating a negative in a printer. If desired, the amount of light may then be set to a predetermined value and a constant exposure used for various pictures. It should be noted though that phototubes such as the 930 are quite sensitive to yellow and red wavelengths and should be shielded from the darkroom safelight. The extension phototube mentioned previously is especially useful in this application and may be used to analyze contrast if desired.

With the circuit illustrated, light values of a fraction of a foot candle are easily readable, making the unit useful for illumination studies. Likewise, under proper lighting conditions the device may be used as a sensitive motion indicator. The available plate current change of better than one milliampere makes it practical to insert a sensitive relay into the plate circuit for use as a selfcontained photocell relay device. These and other applications that may suggest themselves make this simple, inexpensive piece of equipment well worth the attention of the constructor.

—30—

Color Television

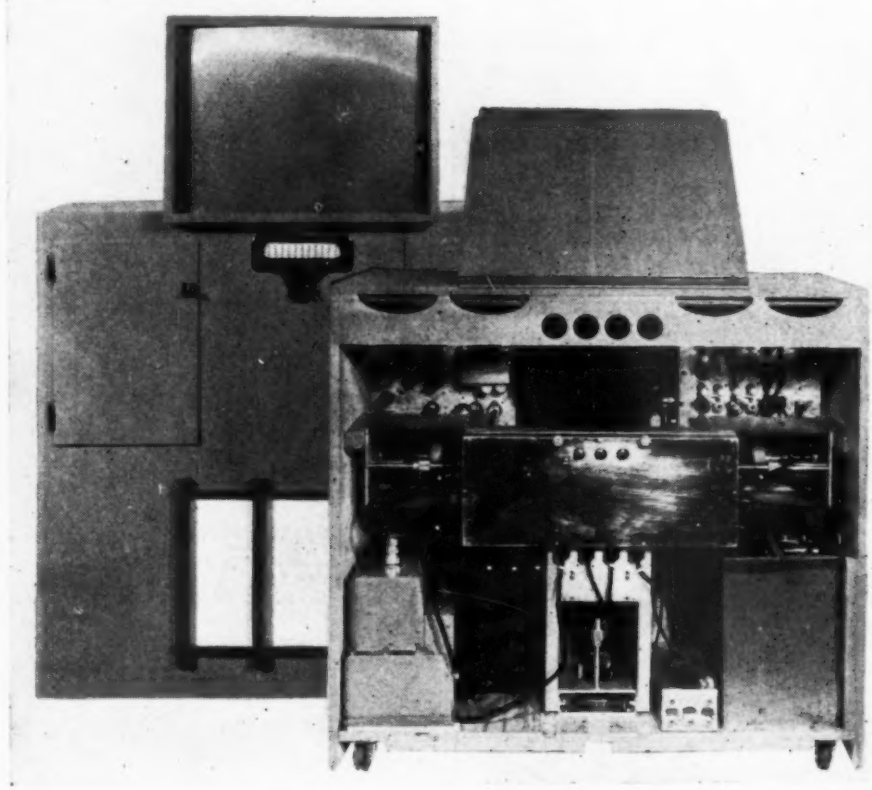
(*Continued from page* 38)

mirror reflects the light rays streaming from the red cathode-ray tube screen, while permitting the green and blue rays to pass. The blue dichroic mirror reflects the blue rays, but permits the green (and all other) rays to pass. An observer, standing in front of the first mirror, thus sees only the combined color pattern of all three tubes.

Another means of mounting the three tubes, in order to obtain the final image by reflection from a silvered mirror, is shown in Fig. 9. Again two dichroic mirrors are required.

It is not necessary to restrict the tube arrangement to direct-viewing tubes. Projection systems are also per-

Fig. 12. Front and rear views of RCA color projection receiver. Image is 15" x 20".



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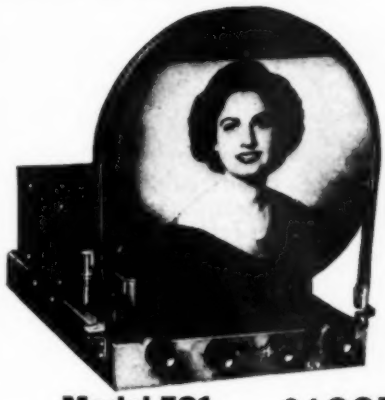

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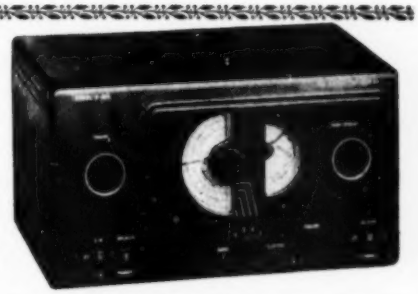

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fectly feasible and Figs. 8 and 10 show the manner in which the projection beams can be combined to form the final enlarged color image. The cabinet to house the projection tubes, Fig. 12, is very similar to black-and-white projection cabinets.

An important feature of this system is its compatibility with television receivers already on the market. From an examination of Fig. 5 it can be seen that to convert a current black-and-white receiver to receive color transmission with the foregoing system requires the addition of color sampling circuits and three color image tubes. Just how expensive something like this may be is difficult to foretell at this time since there is a very distinct possibility that a single cathode-ray tube using three separate guns will take the place of the three color image tubes. Such a tube has been developed experimentally both in this country and in England, but has never been manufactured in any quantity.

Two-Color System. It is claimed by *RCA* that color transmissions can be received with a simplified receiver using two colors instead of three. The two colors are blue-green and green-red. A block diagram of a two-color television receiver is shown in Fig. 2. It is seen to be similar to the diagram of Fig. 5 except that now only two image tubes and two video amplifier systems are required. The sampling method remains essentially the same, although the times when samples are taken of the composite wave is altered.

In Fig. 4, the sine waves due to each of the color pulses are shown separately, together with the composite signal. At time 1, the green sine wave is at a maximum and the other two color signals are passing through zero. Hence, if the receiver sampler takes a sample of the composite wave at this instant, it will obtain a pulse of voltage which is governed only by the green signal. This pulse, if the system is operating properly, will go into the video amplifiers feeding the green image tube.

By the same reasoning, a pulse sample taken at time 2 will represent the red signal and a pulse sample at time 3 will represent the blue signal. At time 4, the sequence starts over again.

For the two-color television receiver, the same signals as in Fig. 4 are shown in Fig. 13; however, the instants when samples are taken have now been altered. The composite signal is sampled for blue-green at a time when both blue and green are in a positive direction. This is indicated by the line marked *B-G*. Similarly, the composite signal is sampled for green-red at a time when both of these components are in a positive direction. This is indicated by the line marked *G-R*. No sample is taken at the third point.

The two samples are fed to separate video amplifiers and cathode-ray tubes and the final image is formed by combining the light output of both screens. A color converter using a two-color picture-reproducing system is shown

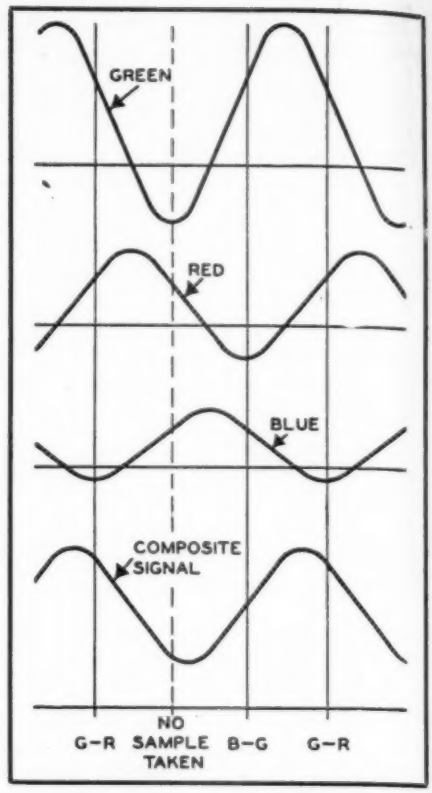

Fig. 13. Operation of the receiver sampler in a two-color system.

in Fig. 14. To keep the cost of this color converter as low as possible, the black-and-white image tube already in the receiver is used with a suitable filter placed in front of it. All we require then is a sampling circuit and a second image tube and a suitable dichroic mirror. If the two-color system is to be used for an inexpensive color television receiver, the two image tubes would possess the proper color phosphors and filters would not be needed.

The CBS System

The *CBS* color system has been labeled by many as a "mechanical" system but *CBS* claims this is not actually so. True, up to now, in nearly all tests run with the equipment, me-

Fig. 14. Two-color picture-reproducing system.

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chanical scanning filters have been used—but the mechanical components could be replaced by electronic methods both at the transmitter and the receiver.

At the studio camera, a rotating color disc is placed in front of an Image Orthicon camera tube. See Fig. 15. The color disc contains the three primary filters, red, blue, and green arranged so that there are four groups of these three primary colors, or a total of 12 filter segments. The light from the televised scene must pass through one of these filter segments to reach the camera tube and in so doing loses all color components except the one which matches the color of the filter. The speed of the disc is synchronized with the action of the electron beam within the camera tube so that one field is scanned while a filter segment is passing in front of the camera tube.

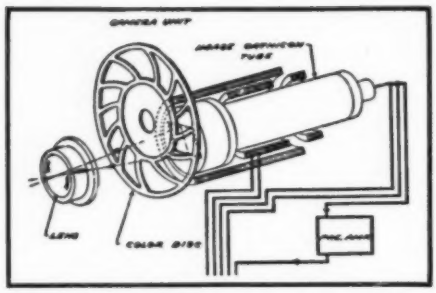


Fig. 15. In the CBS color system, the incoming light rays are filtered by a color disc before reaching the camera tube.

To illustrate, suppose that at any one instant the red filter is in front of the camera tube. During this time, the red filter is permitting only light from the red-colored sections of the scene to reach the mosaic of the tube. With the red filter in position, the electron beam scans the mosaic and the electrical pulses corresponding to the red-colored sections of the scene are formed and transmitted through the video amplifiers. The filter in front of the camera tube remains in this position throughout the entire scanning run (one field of either the odd or even lines) of the electron beam. The same sequence is followed as each of the other filters moves in front of the camera tube. The electrical pulses from each of these scannings follow each other in succession through the various transmitter amplifiers.

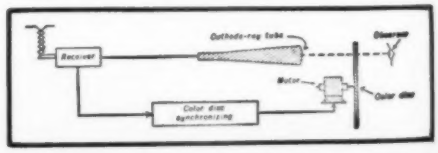
At the receiver (Fig. 16) the pulses arrive in the same order in which they were transmitted. As they are traced out on an ordinary cathode-ray tube screen, the corresponding colored filter should be in position in front of the viewing screen. The observer, in viewing the image through the rotating filter, sees these colors as they appeared when they entered the camera tube. The lines are traced so rapidly that each individual color sequence blends into the next, and only the completed image appears to be present. This is similar to the action with ordinary television images. Here, too, the even and odd lines are scanned separately, but the observer integrates them both in his mind to form the resultant complete image.

To insure that the color disc at the receiver is in step with the color disc at the transmitter, a special synchronizing pulse is incorporated into the video signal.

It is possible to replace the rotating color disc and the single black-and-white cathode-ray tube at the receiver by an all electronic viewing system consisting of three separately colored image tubes. The incoming signals would then be routed by a special circuit to the proper image tube and the final image would be formed by superimposing the light output of each tube. This is similar to the *RCA* system. It is, however, admittedly more economical to utilize the mechanical scanning disc.

The *CBS* color system, as currently constituted, occupies a 4.5 mc. bandwidth, uses 405 lines (as against 525 lines in the present black-and-white system), and 144 fields per second. With these standards the number of picture elements along each line is 45% less than in standard black-and-white pictures. *CBS* claims that with

Fig. 16. Block diagram of CBS color unit.



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normal program material, the loss in detail is not too noticeable.

Thus, we have here the two major systems competing with each other before the FCC. The *RCA* system is essentially a dot sequential system while the *CBS* is field sequential. Demonstrations are being conducted by both organizations (along with others) at the hearings with the avowed purpose of attempting to bring to a head the controversy and possibly enable the FCC to come to a definite conclusion concerning the feasibility of either system (or possibly some other system, of which several have been advanced) and establish a set of standards. It is even possible that the FCC will feel that none of the systems thus far advanced are suitable and refrain from making any decision at this time, preferring to delay the introduction of color television until more experimental data is available. In any event, the choice, or lack of it, is expected to be definitely announced within the next few months. —30—

Ham Unity Returns
(*Continued from page* 55)

present were invited to comment on the various questions.

During the Tuesday session, there was considerable "buzz buzz" in the hall outside of the conference room. Among the most active transients were Jack Doyle, Mr. Segal, Jack Boland, Si Bing and Lew Gilmer. It was quite obvious that these "in the hall" discussions were to attempt a compromise on 12.0, that would be acceptable to the various groups and which, in its revised form, might be acceptable to the Commission.

Several changes were made and while not confirmed at this writing were as follows:

12.0 Basis and Purpose.

(a) Recognition of the value of the amateur service to the public as a voluntary non-commercial communication service, particularly with respect to providing emergency communications.

(b) The continuation of the amateur's proven ability to contribute to the advancement of the radio art.

(c) Encouragement within the amateur service of a program which provides for advancing skills in both the communication and technical phases of the art.

(d) Establishment of a reservoir of trained operators, technicians, and electronics experts.

(e) The continuation of the amateur's unique ability in the promotion of international good will.

This new revision of the philosophy back of the FCC proposals was recommended primarily to satisfy the initial objections of the ARRL in the matter of "as directed" by the FCC.

May we call particular attention to the fact that all of these proposals as accepted by the various groups are simply recommendations to the FCC. All of the suggestions, changes, and other notes will be carefully analyzed first by the Amateur Radio Division, which in turn will make recommendations to the commissioners.

The final acceptance of any new regulations is now entirely up to the Commission and until the Commission sees fit to publish new rules and regulations for Amateur Radio, there will be no change in the present status of our hobby.

It is hoped that by the time this issue reaches you the Commission will have issued new rules and regulations governing Amateur Radio.

—30—

SOME HAM CONTACTS NIXED

THE FCC has notified American hams that a number of foreign governments have clamped down on intercountry contacts.

The International Telecommunication Union advised the FCC that the following countries have forbidden foreign communications: Austria, Burma, French Oceana, Greece, Indo-China, Indonesia, Iran, Israel, Lebanon, Madagascar and dependencies, Mauritius, Netherlands Antilles, Siam, St. Pierre and Miquelon, and Togoland.

Under international agreement communication between hams of different countries is forbidden if the government of one of the countries objects. This ruling is now in effect, and any attempt on the part of American hams to contact amateurs in the named countries could lead to a suspension of license. —30—

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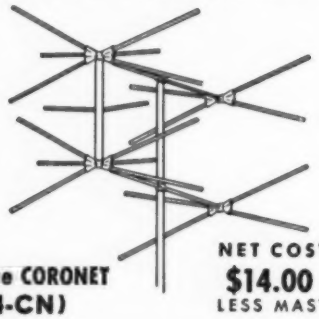

The CORONET (4-CN)
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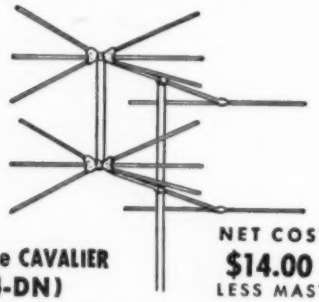
This conical array assures maximum distance reception. Tests prove this model outperforms other stacked types as far as 100 miles from transmitter. High frequency lobes optional.



The CAVALIER (4-DN)
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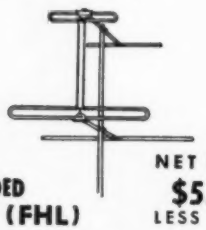
Another Warren first. Clear pictures result from single reflector on each stack. Gives maximum performance at maximum distances from transmitter. HF lobes provided on request.



The FOLDED HI-LO (FHL)
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Mac's Service Shop

(*Continued from page* 53)

brilliant suggestions for separating me from my hard-earned cash?"

"I was just debating with myself whether I should let you buy the combination AM, FM, and TV radio, complete with a dual-speed record player, that is coming in next week," Mac said musingly.

"*Let* me buy it! I'd like to see you make me. Why you are the very one who discouraged me from buying a straight television set when I wanted to do so a couple of months back. You said that in this ultra-fringe area reception was too erratic and spotty for me to get my money's worth out of a set at this time. Now you are talking about my buying a combination outfit that will cost twice as much!"

"Just keep your shirt on, old scissorbill," Mac said soothingly, "and I'll try to explain. First, you *need* a new radio and record player. That one you have now has served long and faithfully, and it is still in fair shape; but many improvements have been made in radios and record players since it was designed. Your whole family really enjoys good music, and I know that you would get a great deal of pleasure out of hearing the tone quality to be had from a modern top-quality combination radio and phonograph."

"Then why don't I just buy me a radio-phono combination?"

"Because TV is coming fast, and we are certain to have excellent reception here in a year or so. In the meantime, there are many nights when video reception here is very good, even with a comparatively simple two-bay antenna erected on the roof. If you had this combination, you would be in a position to enjoy the visual programs when they were coming through. On the nights when they were not, your purchase would not be sitting idle, as would be the case with a straight TV set. You could still enjoy the fine AM or FM programs, or you could listen to your records.

"In this way you would be in on the entertaining and exciting development of TV—something that you will miss if you wait until perfect reception is to be had here."

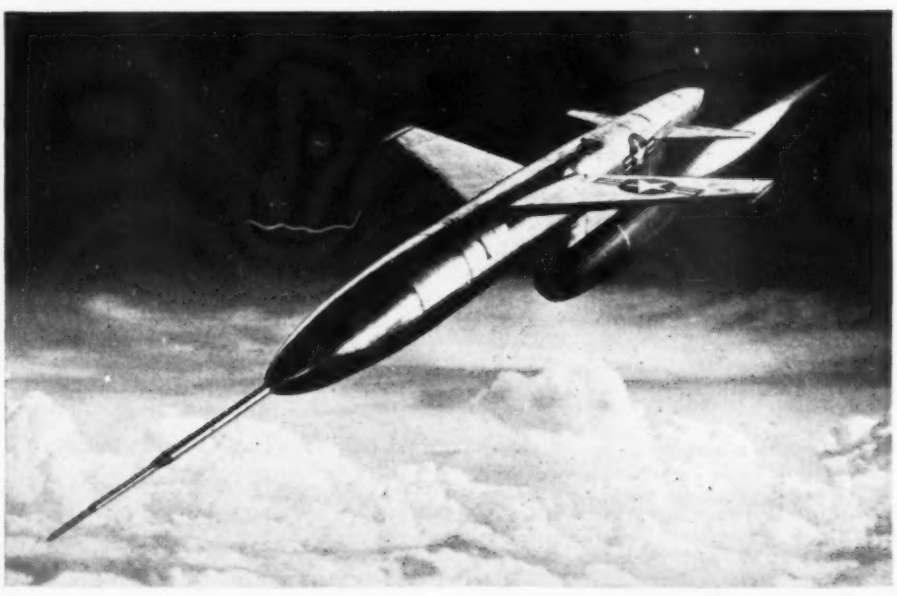
"But isn't there danger that my set will quickly become obsolete?"

"After watching the way the FCC has safeguarded the buying public in the past, I am quite willing to trust them to take care of this matter in the future."

"By golly, I believe I'll buy it!" Bill said with sudden enthusiasm. "I know darned well I got more kick out of listening to Harry Snodgrass playing the piano at WOS on a three-tube blooper than I get out of all the programs I can hear today. The fun is in being in on the ground floor of something new, and that argument of yours about a combination being a better investment makes sense. Give me a ring when it comes in. Now I've got to go. Since you three have got all of my money, there's no use staying around here any longer."

As he went out the door, he was whistling *All I Want for Christmas Is My Two Front Teeth*, but his face wore that self-satisfied look of a man who had completed his Christmas shopping early and satisfactorily. —30—

Displacing slower-speed towed or remote-controlled aircraft targets, a new radio piloted ramjet type Martin KDM-1 target drone can dart through the skies at an ultra-high speed close to that of sound. The new practice vehicle is an improved version of the Martin Gorgon IV, shown below, developed by the Glenn L. Martin Company, which was the first successful pilotless aircraft to be powered by ramjet engines. KDM-1 drones will be used by the U. S. Navy to simulate maneuvers of the fastest fighter planes in order to sharpen the eyes of the surface fleet anti-aircraft gunners. Remote-controlled by radio after launching, when the gasoline fuel supply is exhausted, they zoom upward opening a parachute and are gently dropped into the ocean from which they can be retrieved and repaired for other flights.



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2×10	150
2×20	25
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40+40	150
40+20	150
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10	200
8	450
40	250
40	150
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25/40	25/200
2×40	150

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225	15
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20/30	250
2×30	150
30+20	150
30/20	350/25
10/50/100	450/100/50
15—15/20	350/25
15/15/40	150/25
25—25/10	25/350
20—20/10	50/400
2×20	150
20/20	400/25
10—20/20	350/25
10—15/20	350/25
15—15/20	350/25
10—10/20	350/20
3×10	150
3×8	150
12	525
15	450
10	450
20	525
80	150
40+20+20	150
40/20	150/25
40/25	200/25
40/30	150
10/50/100	350/100/50
10/10—10	25/150—150
16	450
20	350
15	250

2×90/20	200/50	$.69
150—20/8	25/50	.49
120—60-20	150/25	.49
3×20	450	.59
2×20/20	450/25	.39
20—8/25	450/25	.49
40—20/20	450/25	.69
40+10+10	450	.89
40/40/25	475/400/50	.59
40/20/25	450/50	.69
40/40/16	450/400/350	.79
4×20	450	.98
2×30—15/20	400/25	.89
30—15—10/20	450/25	.79
3×10/10	450/25	.69
3×10/20	400/25	.69
80—40/150	400/50	.98
2×80/60	250	.65
150—50—25	150	.49
20—10/50	450/50	.49
2×20/20	400/25	.59
40—20/20	400/25	.59
40—40/25	400/25	.59
40—40/150	450/150	.69
40—40—10	450	.69
40—30—10	450	.79
3×15—30	300	.69
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30	450	$.49
30	300	.45
30	350	.48
40	450	.45
40	525	.60
16	350	.35
16	525	.45
16	450	.40
16	100	.24
20	25	.20
20	80	.25
20	450	.40
24	350	.30
8	400	.30
8	150	.15
10	150	.20
10	50	.15
4	50	.10
4	150	.14

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MFD.	VOLT	PRICE
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20—20	150	.34
22—20	250	.45
30—30	150	.40
32—32	350	.49
30—50	150	.42
40—20	150	.42
32—32	250	.49
40—40	150	.42
32—16	450	.55
3×40/10	150	.70
80—40—30/100	150/25	1.29
8—8/25	450/75	1.10
30—20/20	450/25	1.10
20—16/10	200/25	.50
50—30	350	.55
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20	150	.18
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550VCT	.100	6.3V/1.8, 6.3V/.6	2.29
580VCT	.040	5VCT/3	2.95
700VCT	.017	5VCT/3A	2.25
2300V	.004	2.5V/2A	8.49
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1080VCT	.055	6.3V/1.2, 6.3V/1.2	5.49
600VCT	.155	6.3VCT/5, 5VCT/3	3.95
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Plate Transformers—115V/50-60 cps input

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500VCT & 650VCT	150-.015	3.00	100V	3.	1.95
2x150V	2x.940	4.25	1620VCT	.400	11.95
600VCT	.0165	2.49	240VCT	.180	3.95
250VCT	.077	4.95	121V	1.5	2.25
680V	450		126.5V	1.5	
1470VCT	1.2	24.00	132V	1.5	

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36V/1.11	1.49	6.3V/2.5, 2x2.5/7	3.25
5VCT/20A	5.49	2x2.5VCT/6.5A	3.25
4V/16A, 2.5V/1.75 HV INS.	3.95	2.5V/1.75A, 5V/3A 6.5V/8A, 6.5V/.6A	3.85
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230V 60 Cy	2.5V/6.5A	1.95
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1 Mfd 2000VDC	1.00
2 Mfd 1500VDC	1.00
10 Mfd 1000VDC	1.95
15 Mfd 1000VDC	2.25
3 Mfd 2200VDC	1.95
6 Mfd 1500VDC	2.15
45 Sec Time delay Relay 110V input	1.95
14 Mfd 330VAC 200VDC Int.	$2.95
1 Roll 35MM Photo Paper 1¼x250 Ft. Lg. EKCo #2 Pkd in Tin. Perfect Condition	75c ea.

XFMR TELEV PWR SUPPLY KITS

BASIC 3" and 5" T.V. PWR SUPPLY

Trans. 1080V/55Ma, 6.3V/1.2A, 6.3/1.2A, 2-.1 Mfd 2500V 2X2 Tube, Socket, 1-100000 ohm Resis. Price $7.49

BASIC 5" AND 7" TV PWR SUPPLY

Trans. 2300V/4Ma, 2.5/2A, 2-.1 Mfd 7500V Pyr. 2X2 Tube, Socket, 1-100000 ohm Resis..... $9.50

TV TRANSFORMER

3000V/5Ma, 720VCT/200 Ma, 6.4V/8.7A, 6.4V/.6A, 5V/3A, 1.25/.3A Fil & Plate Voltage for 7" & 9" Tube $4.95

BASIC 15 WATT AMPLIFIER

Pwr. Supply contains Trans. 600VCT/.155MA, 6.3V/5A, 5V/3A, 2—7 MFD 600V, Dual Choke, 10HY 200MA, 5T4 Tube, Socket, Price..... $8.49

BASIC 50 WATT AMPLIFIER

Pwr. Supply contains Trans. 880VCT/200MA, Dual 10HY 200MA Choke, 2—7MFD 600V, 5T4 Tube, Socket, Price..... $10.49

VARIABLE TRIMMER CONDENSERS

C714	3.2-42Mmf	.23c
C713	2.8-27Mmf	.20c
C717	2.8-35Mmf	.23c
A289	3-25Mmf	.21c
1741	3.9-50Mmf	.23c

Write for Other Values

LINE FILTERS

LINE FILTER. GE 100 Amp Filter w/2 x 5Mfd 50V oil cond. Operates on 110VAC DC..... **$1.79**

1KW LINE FILTER, clean up RCI & TVI. With 4-.002Mfd Cond. Easy to Mount... **$3.95**

Noise Filt. Jx51E. 10 Amp 98c

Noise Filt. Jx55D. 4 Amp 35c

HiGain Dyn Mike Xfmr UTC/SuperElec 3wdg 600 CT&4000 ohms tapped 250&150 ohms. Fully Shielded Herm. Sld..... **49c**

2 for 95c; 10 for ..$4.80

COLLINS ART-13 FREQ. MULT. UNIT

2-18 Mc for two 1625 Tubes. Comp. Assy less Tubes w/ckt diag. Price..... **$8.49**

Birtcher Tube Clamps

926C	926—A11
926—16	926—C15
926—B1	926—C13
926—B2	926B
926—B8	
926B—16	
926A—14	13c ea.
926C—19	100 for
926A	$12.00
926—C1	

ARC 5 PARTS EQUIPMENT AND KITS

80 Meter Xmttr Conversion Kit	$1.50
40 Meter Xmttr Conversion Kit	1.50
40 Meter Rec Conversion Kit	1.75
3 Pos Switch Eliminator for BFO	19c
Fuses 10A 3AG	5c
Condenser Kit 4-3x.05 Mfd 1-15 Mfd	75c
Cond .05-.01-.05	19c
Cond 3x.05	19c
Loading Coil 80 and 40 Mtr.	69c
Modulation Xfrmr 807 to Parallel 807	$1.00
Control Box	1.00
Xmttr Pushbutton	1.00
Xmttr Rack	1.98
Shock Mts for Rec.	35c
Control Cable	$1.19
Modulator w/Dyn & Tubes, New	6.95
Parasitic Suppressors	10c
Var Cond Rec Trans.	98c ea.
Dial Plates Rec Trans 190-550 Kc	10c ea.
Plates for Control Box 190-550 Kc, 3-6 Mc, 6-9.1 Mc.	10c ea.
RF Choke, 2.5 Hy	19c
Kit of 2—5 MFD cond 1 Choke 5634, 1 Trans 692327-1, 1 Choke 5546, all for	98c
HF Coil ESL 693-865 S.T.	19c
RF Sections, 190-550 Kc, 6-9.1 Mc	50c ea.
IF Coil 6-9.1 Mc Slug Tnd.	49c
Control Box Switch	15c
PL 154 12 Png Female	30c
PL 153 18 Png Female	30c
PL 148A 3 Png Female	30c
9821 8 Png Female	30c
5542 7 Png Male	30c
6578 2 Png Female	30c
5577 6 Png Male	30c
6418 8 Png Male	30c
7027 18 Png Male	30c
Any 4 Plugs	$1.10
Dyn Plug 3 Png	10c
RF Sect Plug 3 Png	10c
Chassis Plug Mount 7 Png.	18c
Neon Ind Bulb	15c
15 Mmf Trimmer	15c
Relay 24v Dpdt	49c
24v 4pdt	69c
12SK7 Tube	59c
12SR7 Tube	59c
12A6 Tube	29c
12SF7 Tube	59c
Ant Feed Thru	12c
Ant Loading Coil TN6 Complete	$1.98
Junction Box includes 12 Plugs, 6 Ckt Bkrs, Switch, etc. J17A	$2.49
Junction Box J22 for Tel & Mike	39c

Write for Other Material

ARC 3 COMPLETE AUDIO MODULATION XFMR PKG.

T103 Carbon Mike to Grid. Price 95c

T102 6J5 to PP 6L6 GRIDS (Modulation) $1.15

T104 MOD. XFMR PP 6L6 to 832 or 8298 Plates..... $1.49

COMPLETE KIT OF THREE $2.98

Precision Resistors

ohms	ohms	ohms
1.01	250	10000
3	430	12000
5	468	17000
5.05	800	17300
10.1	920	20000
18	1100	25000
43.8	1450	30000
50	1900	33000
75	2230	35000
82	4300	40000
120	5000	50000
125	7000	55000
128	7500	57000
150	8500	75000
200		

Each 25c; 10 for $2.00

84000	150000	250000
100000	170000	500000
120000	220000	

Each 35c, 10 for $3.25

1 Meg. ea.	70c
6.330 Meg.	$1.00

Heineman Ckt Bkrs. For AC-DC Operation. Amperes .010, .3, .7, .10, .50, .80, .100.

150. Ea. $1.45
Klixon 25A 98c
Dual 8 & 25 Amp. .. $2.49
De Ion 35 Amp. $3.29

XMTR COILS AIR WOUND

80 MTR Bar Prong 100w $1.19

40 MTR. 5 Prong 50w plug in socket..... $1.19

160 MTR 5 Prong 50w plug in socket..... $1.19

40 MTR 3 Prong Bar 100w $1.19

#C538 2-3.5 MC 300w Fix. Link $1.19

#1735 2-3.5 MC. 300w Var. Link $1.49

#C390 5-7 MC. 300w Fix. Link $1.19

160 MTR Bar Type 100w $1.19

ROTARY BEAM COUPLER

RF Coupler 360° rotation 1 turn coupling link. Plastic case mount on side. Price.... **$2.95**

932 PHOTO TUBE

Gas Phototube having Si response, particularly sensitive to Red and Near Infrared Radiation. Can be used with incandescent light source. Send for Data. Price..... **75c**

1619—1619—1619

Octal Base Pentog Avarsatile High Perveance Tube **21c**

5 for..... New $1.00

INTERPHONE CONTROL BOX

Permits Transfer of H.S. from Receiver. 4"x4" WD x 2" D. Contains JK-33A, JK-34A, Toggle Sw. Lum. Tip. Pot. 50,000 Ohm. Term. Strip. A REAL BUY. PRICE..... 50c

T.V. Transformer, 7" or 9" scope. 3000v/5MA, 720 vct/200MA, 6.4/8.7A, 6.4/.6A, 5/3A, 1.25/.3A. Price.. **$4.95**

RHEOSTATS

5 ohms	250w	$1.98
50 ohms	25w	.49
250 ohms	25w	.59
1000 ohms	50w	.98
15000 ohms	4w	.39

RECTIFIERS

K8 9020. 20 MA. Twenty 12V Discs. 1¼" Dia. Two stacks, one of 5 other 15 discs for TG30. Price $3.49

Rect. in 7.1VAC—Out 2.4V @ 3A Cal. 61289 Dual Sel. Price $1.49

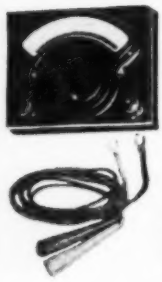
Rect. Full Wave in. 180 VAC. Out 120VDC .4A. Price $3.49

Rect. 36V in/28V Out/1.5 Amp. $1.49

Rect. Dual Input 2.2V @ 1.5A: Out w/6.5V for SCR 593-BC728. Price $1.49

COMMUNICATIONS EQUIPMENT COMPANY
RADAR TELEVISION ELECTRONICS
FM MICROWAVE RADIO · SONAR
CABLE ADDRESS: COMSUPO
PHONE DIGBY 9-4124
131 LIBERTY ST. DEPT. N
NEW YORK 7, N.Y.
C.E.C. MONEY BACK GUARANTEE, $3 MIN. ORDER
F.O.B. N.Y.C. SEND MONEY ORDER OR CHECK, ONLY SHIPPING CHARGES SENT C.O.D.

SURPLUS



HOYT MODEL-515
0-15 AMPERES
DC METER

MIRROR SCALE

Includes test leads and steel carrying case. Meter size 4 x5'. Basic movement approx.12ma.

Special $3.33 Each
10 FOR $30.00

SURPLUS EQUIPMENT
Trouble Shooting Manuals

(Includes Schematics)

BC-348 Receiver
BC-779 (Super-Pro) Receiver
SCR-522 Transmitter-Receiver
BC-610 Transmitter

ANY BOOK $1.00 EACH

(Add 10c for postage) Quantity Discounts

COMMAND RECEIVERS

BC 453 Rec. 190-550 kc—New $12.95
BC 454 Rec. 3-6mc—New 6.95
BC 455 Rec. 6-9mc—New 6.95

SPECIAL!!
FL-8A FILTERS $1.37

ALLEN-BRADLEY
TYPE "J" POTENTIOMETERS

100 (SS)	10K	25K
500	10K (SS)	25K (SS)
1000 (SS)	15K (SS)	50K (SS)
6500 (SS)	20K (SS)	60K
100K		250K (SS)
100K (SS)		500K (SS)
150K		1 meg. (SS)
200K (SS)		

All shaft lengths min. ¾" except where marked (SS)—crew-slot ..... 38c each

COAXIAL CONNECTORS

83-1AP	$ .09	UG-30/U	$ .94
83-1H	.10	UG-33/U	14.80
83-1J	.68	UG-34/U	12.80
83-1R	.28	UG-36/U	12.40
83-1RTY	.45	UG-37/U	12.40
83-1SP	.28	UG-88/U	.57
83-1SPN	.28	UG-85/U	.62
83-1T	1.12	UG-86/U	1.22
83-22AP	.85	UG-87/U	.68
83-22F	.88	UG-171/U	1.33
83-22R	.52	UG-176/U	.16
83-22SP	.48	UG-180A/U	3.82
UG-7/AP	2.14	UG-191/AP	.57
UG-12/U	.63	MX-199/U	.41
UG-21/U	.67	UG-197/U	1.33
UG-22/U	.86	UG-206/U	.58
UG-23/U	.63	UG-254/U	.88
UG-24/U	.67	UG-255/U	.82
UG-27/U	.68	UG-264/U	1.74
UG-29/U	.83	MX-267/U	.15

TUBE SPECIALS

GUARANTEED BRAND NEW
—STANDARD BRANDS ONLY—
SELECTED FROM OUR COMPLETE LISTING

1A3	$0.45	7E5	$0.29	304TL	$0.89
1B3GT	1.18	10Y	.19	316A	.66
2A3	.89	12A6	.24	446A	.79
2X2	.49	35Z5GT	.44	807	1.15
5Y4G	.38	50L6GT	.57	811	1.71
5Y4GT	.46	3AP1	4.63	813	6.95
5Z3	.59	3BP1	2.59	815	1.72
6AC7	.79	5BP1	1.89	866A	.95
6AG5	.89	5CP1	2.87	1613	.61
6AK5	.89	5CP7	3.76	1619	.19
6AL5	.69	5FP7	.57	1624	.69
6AQ5	.72	5HP4	2.90	1625	.19
6BG6G	1.72	1P24	.29	1626	.29
6C4	.21	2051	.49	1629	.29
6J6	.89	2C22	.22	9001	.42
6L6GA	.87	2C26	.27	9002	.39
6SL7GT	.69	RK-34	.28	9003	.39
6SN7GT	.64	24G	.44	9004	.39
7C4	.19	211	.62	9006	.29

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LECTRONIC RESEARCH LABS

1021-R Callowhill St. Phila. 23, Pa.

Within the Industry

(*Continued from page 28*)

ANCE AT TIMES SQUARE recently opened its doors at the "crossroads of the world," 42nd and Broadway, in New York City. The new company will retail *RCA Victor* television, radios, radio-phonographs, and records exclusively. . . . **THE HOUSE OF TELEVISION, INC.,** New York, manufacturers of TV filters, screens, and video accessories, has recently moved its factory, offices, and showrooms to 40 West 4th Street, New York City.

* * *

LEONARD C. TRUESDELL is the new sales manager for *Zenith Radio Corporation's* line of household radio and television receivers.

This newly-created post in the company was necessitated by increased activity in these lines and Mr. Truesdell will be responsible for all sales activities of the household division including sales promotion, advertising, and sales training.

Mr. Truesdell has been associated with radio and appliance businesses since 1923. He has been connected with such well-known firms as *Frigidaire, Crosley, Bendix,* and *Hotpoint.* He joined *Hotpoint* in 1946 as vice-president in charge of marketing and in three years' time completely rebuilt the organization's national sales setup.

* * *

DR. ADOLPH E. ROSENTHAL, well-known physicist and inventor, has been named director of physics of *Freed Radio Corporation* of New York. **J. W. RONDEL,** formerly sales manager of table and portable radios at *General Electric,* has been appointed assistant to the GSM of the company's Electronics Department. . . . **D. E. WESTON** has been named merchandising manager of *General Electric Company's* Receiver Division. . . . *The Magnavox Company* has named **STEWART ROBERTS** as director of merchandising and assistant sales manager and **LAUREN K. HAGMAN** as director of advertising and public relations. The posts are new ones with the company. . . . **AB WAXMAN** is the new general manager of *Wireway Corporation of America,* manufacturers of wire recording equipment. . . . *Allen B. Du Mont Laboratories, Inc.,* has named **ROWLAND GUILDFORD** to head its newly-formed, company-owned distributorship in the New York area and appointed **FRANK A. OBERNDORFER** to the post of assistant advertising and sales promotion manager of the receiver sales division. . . . **AL FRIEDMAN** has been appointed chief engineer and national field service representative for *Radio Merchandise* Sales, Inc., of New York . . . **RADIO INVENTIONS, INC.** has announced a corporate name change to *Hogan Laboratories, Inc.*

—30—

SIMPLIFIED CALCULATIONS RC COUPLING CIRCUITS

By LEON G. WILDE

THIS graph and formulas were designed with the aid of the "Radiotron Designer's Handbook" and greatly simplify the design of RC coupling circuits. With them it is possible to find RC for a given number of decibels attenuation at a given frequency and determine the frequency at which a given circuit has a given number of decibels attenuation. The value of the constant, K, is dependent upon the decibels attenuation, as shown in the graph.

To find RC for a given attenuation at frequency F, look up on the graph the value of K for the number of decibels drop desired, and divide this value of K by the frequency in cycles-per-second. This will give RC. Note that in all formulas R is in thousands of ohms, C is in microfarads, and F is in cycles-per second.

To solve the other types of problems mentioned, merely substitute the unknown values in the correct formula and solve for the desired quantity.

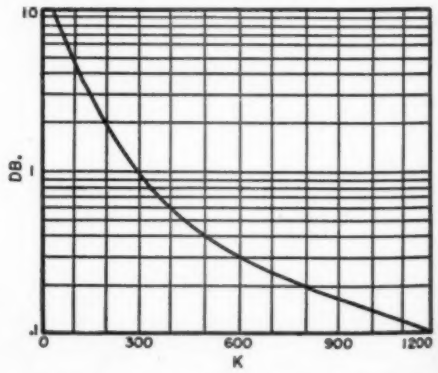
$$RC = K/F$$
$$F = K/RC$$
$$K = RCF$$

As an example. An RC coupling circuit uses values of .002 μfd. and 500,000 ohms. At what frequency will the circuit have an attenuation of 2 db.? Since the frequency is to be found use the formula F = K/RC. Consulting the graph it is found that for a value of 2 db., K is 200. Substituting the values of 200 for K, .002 for C, and 500 for R, we find that the frequency is 200 c.p.s.

When a number of such circuits are used in cascade, as in an amplifier, dividing the total db. drop desired for all circuits by the number of such circuits will give the number of decibels per circuit on which to base calculations.

These calculations hold true only when the plate resistance and load resistance of the preceding tube are small in comparison with R. In cases where this does not hold, such as in the case of a pentode, use as a value for R the sum of the grid resistor and the resistance of Rp and Rl in parallel.

Graph to be used in conjunction with given formulas to determine the proper RC values to be incorporated in coupling circuits.



PLATT PLAYS SANTA

AUTOMATIC CREDIT AGAINST ALL $10 ORDERS

That jingle, jangle may be sleigh bells in Platt's ears—but this month it's REAL SAVINGS in your pocket. For Platt's on a Xmas binge and you reap the benefits! Yes, with every $10 order you place, simply deduct $1 as Platt's present. (On $20 purchases you get back $2, etc.) This special offer is good for December ONLY—SO HURRY!—place your orders now!

OIL FILLED CONDENSERS

CORNELL DUBILIER TJH 50020, 2 MFD, 5000 VDC $4.25
CORNELL DUBILIER, 2 MFD, 600 VDC 29c
CORNELL DUBILIER & SPRAGUE, 4 MFD, 600 VDC 79c
GENERAL ELECTRIC 23F47, 2 MFD, 4000 VDC $3.25
GENERAL ELECTRIC .25 Mu-f, 6000 VDC ... 1.95
GENERAL ELECTRIC 30 Mu-f, 90 V, 3 phase, 60 cycles 1.19

TRANSMITTER-RECEIVER

Conversion of 645 for use on Citizen's Band Bringing Excellent Results.

Navy Model ABA-1 (CG-43AAG)
Army Model SCR-515A known as the BC-645

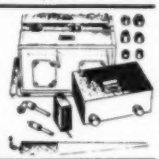
450 MC—15 Tubes

BRAND NEW—ORIGINAL CARTON. Can be easily converted for phone or CW 2-way communication. Covering for the following bands: 420-450 MC ham band, 450-460 MC for fixed or mobile, 460-470 MC for citizens, 470-500 MC television experimental. Size 10½ x 13½ x 4¾. Contains 15 tubes: 4-7F7, 4-7H7, 2-7E6, 2-6F6, 2-955, 1-WE-316A door knob. Complete as shown above. ..... only $17.95

BC-645 ANTENNA ..... only 39c

BC-645 TRANSMITTER-RECEIVER ONLY. Brand New, ORIGINAL PACKING. Special $12.95

Reconditioned Like New
SCR-522



with new components very high frequency transmitter-receiver.

100-156MC, 4 Channels, Crystal-Controlled, Amplitude Modulated Voice. Complete as shown. ONLY $79.50

HEADSETS—Excellent Buys!

HS-33 with cord and plug, used, good condition $1.19
HS-23—Brand New with ear pads 2.75
HS-33—Brand New with ear pads, cord and PL54 plug..... 2.75

EXTENSION CORD

DC-307A with PL55 and JK26 —65 inches ..... only 59c

BEACON RECEIVER BC-1206-C

Manufactured by Setchell-Carlson

Frequency Range—195 KC to 420 KC. IF Frequency—135 KC. Receiver Sensitivity—3 Micro volts for 10 Milliwatts output. Output Impedance—300 Ohm and 4000 Ohms to be selected internally. Power Output—230 Milliwatts. Volume Control—RF Gain Control. Power Supply—24-28 Volts Aeroplane Battery. Current—.75 Amperes.

BRAND NEW—ONLY $6.95

SPECIAL!
DYNAMOTOR

for DY-12 Power Supply for ART-13. NOW ONLY $9.95 complete

10 LENGTHS SPAGHETTI

Assorted Sizes—2½c. In lots of 100 lengths $2.50

Minimum Order $2.00

Immediate Delivery—Send 20% deposit on C.O.D. orders. All shipments F.O.B., N.Y.C. (N.Y.C. residents add sales tax to your remittance.)

FIELD TELEPHONES

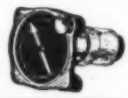
Army surplus, completely reconditioned with new handsets, electrically tested, in excellent used condition. Only $6.95

BRAND NEW FIELD TELEPHONES $9.25

TYPE MN-20E ROTATABLE LOOP UNIT

8" diameter, used with MN-26 Compass and RA 10DB. Manufactured by Bendix.
A REAL XMAS BONUS! ONLY $11.95

SELSYN INDICATOR



For use with beam antennas for indicating direction of antennas. 1-82-B, 5" type. Now $4.95

ANTENNA TIE DOWN EQUIPMENT

One rope 15 ft., 1 steel fitting, 1 porcelain insulator. Each 29c
In lots of 6 only 25c each.

Multitester Foundation BIAS METER 1-97A

Contains a zero center 3½" round Marion voltmeter calibrated 0-100 volts each side. Movement is one mill each side of center. The unit is mounted in a steel box, 7" x 5" x 4½" and contains 8 contact push button, line cord dual 100 MFD at 200 V DC Aerovox condenser, a potentiometer 6 1RC 1% wire wound non-inductive resistors: one 400 ohm, two 2500 ohm, one 5000 ohm, one 10,000 ohm, one 15,000 ohm.
Excellent for building a zero center multitester with ranges of 1, 10, 100, 1000 volt.
COMPLETE BRAND NEW $3.95

Allen-Bradley Relay—24 Volts, DC	$ 0.79
Bird Control Box. 2 BC-461-A	.89
FL-5 Lazy Q Radio Filter Unit, High Impedance, Brand New	.75
Mazda 623, 24-28 Volts, Pilot Light, Box of 10 ..... Special	.69
BC-348 RECEIVER—Brand New—Original Packing ..... Now	165.00
BC-348—Excellent Condition—Used ..... Only	125.00
PE-94C Dynamotor for SCR-522—Brand New ..... Now	5.95
BC-602 Control Box for 522—Brand New ..... Special	.98
Plugs—Set for 522—Brand New ..... Only	4.95
PL55 Plug ..... Only	.25
PL68 Plug ..... Only	.12

274-N COMMAND EQUIPMENT

Sensational Buys!

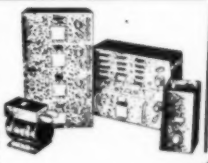
	USED	BRAND NEW
BC-442	$ 1.85	$ 2.75
BC-453	12.95	
BC-454	4.95	6.95
BC-455	6.95	
BC-456	1.95	2.95
BC-457	5.95	
BC-458	5.95	7.95
BC-606	14.95	24.95

PLATT'S TOPS IN TUBES, TOO!

5BP4	$2.45	4AP10	$4.95
872A	1.47	7CP1	2.95
10Y	.39		

Standard Brands All New Tubes

WAR SURPLUS BC-375-E TRANSMITTER



Here's a sensational buy! Has five tubes, five tuning units. Xmtr. designed to operate from 200 kc. to 12 mc. (less BC band). Equipped with antenna tuning unit BC-306-A—variometer and tap switch. Dynamotor (PE-73-C) complete with relay, fuses and filter. Weight: approx. 275 lbs. Excellent Condition. SPECIAL $44.50

AN/APN-1 RADIO ALTIMETER

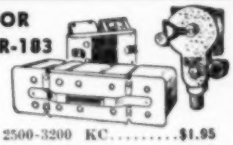
New — original packing, complete ready for operation. Just Few Left! Only $29.95

RUSH COUPON TODAY!

DYNAMOTORS

Type DM-33-A, in. 28 V, out. 540 VDC, 250 mils ..... Brand New	$1.95
(Excellent—Used	1.25)
Type DM-53-A, 24 V., in. 220 V, 80 MA out. ..... Brand New	1.95
INVERTER—PE-206, 28 V. in., 80 V at 500 VA, 800 cy. out. ..... Brand New	4.95
(Used, Excellent Condition	3.25)

COIL SETS FOR RADIO SET SCR-183



All Brand New—Terrific Buys!

TYPE		
C-381—Transmitting	2500-3200 KC	$1.95
C-382—Transmitting	3200-4000 KC	1.95
C-384—Transmitting	5000-6200 KC	1.95
C-266—Receiving	2500-4700 KC	3.95
C-376—Receiving	2500-4700 KC	3.95
C-377—Receiving	4150-7850 KC	3.95
MC-125 Tuning Unit, part of radio set SCR-183		.79

BD-72 12 line portable monocord, magneto-telephone SWITCHBOARD used primarily in field wire systems. BRAND NEW $22.95 USED, EXCELLENT CONDITION $14.95

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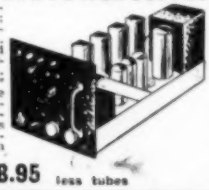

4 switch-selected screwdriver tuned RF channels: IF freq. 1050 kc, bandwidth 45-60 kc; RF freq. 16 2000 kc. Makes fixed tuner for med. freq. police calls or PA system. Has power supply for 5" scope, with 400 cycle trans. Electronic controlled low v. supply; delivers 260 vdc, 150 mils reg. to .01%. Power supply alone worth more than price.

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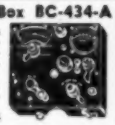

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IMPORTANT—All coupons must be in our hands by midnight, Dec. 24, 1949. The drawing will take place on Christmas day. Winners will be notified immediately by telegram and their names listed in one of our future advertisements in Radio & Television News.

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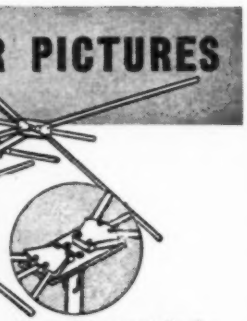

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TV Receiver Alignment

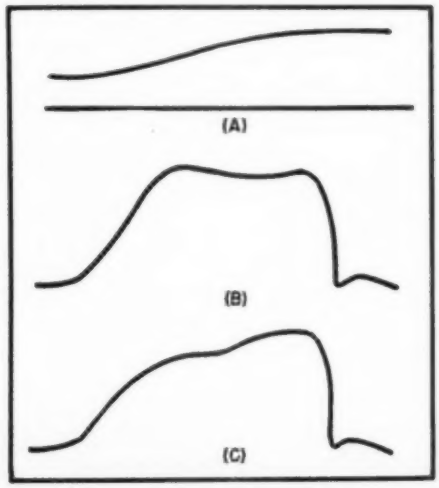
(*Continued from page* 68)

true response of an amplifier aligned with that particular sweep generator. If the nature and the amount of the deviation from flatness of a sweep generator is known, then allowances in the curve shown on the scope can be made in order to produce an acceptable alignment job. For instance, if the output over the picture i.f. band of a particular sweep generator looks like Fig. 7A, and the desired response of the picture i.f. amplifier is shown in Fig. 7B, then the amplifier should be adjusted to produce a curve on the oscilloscope similar to Fig. 7C.

Most of the inexpensive sweep generators which obtain their output by beating a frequency-modulated oscillator against a fixed-frequency oscillator cannot be checked with the simple detector of Fig. 6. These generators have, in addition to their output in the desired frequency range, several spurious frequency outputs of the same order of magnitude as the desired output. This is ordinarily of no great consequence in practical alignment work since the amplifier being aligned will normally reject the spurious outputs. However, with a sweep generator of this type, it is more difficult to determine whether or not the output over the desired band of frequencies is flat.

The most practical way to do this is to use the sweep generator to display the response curve of an amplifier which is known to be in good alignment. If the curve obtained in this manner is similar to the known response of the amplifier, then the output of the sweep generator can be assumed to be relatively flat over the band of frequencies passed by the amplifier. In this event, the sweep generator can be used without fear of error to align other amplifiers which pass the same frequency band.

Fig. 7. Compensation for sweep generator which does not have flat output. (A) Sweep generator output. (B) Desired response. (C) Trace which must be seen on scope to produce desired response.



If the curve does not look like the known response of the amplifier, then the sweep generator output is not flat, and compensation must be made for this fact when aligning other amplifiers. For instance, if the curve is lower than it should be on the high-frequency end, then, since the amplifier is known to have a normal response, it is reasonable to assume that the sweep generator output is also low on the high-frequency end of its swept band. In this case, an amplifier aligned with this sweep generator must be aligned so that its response, too, is low at the high-frequency end.

These hints on compensating for sweep generators whose outputs are not flat are good only when the deviation from flatness is not too great. It is generally more economical in the long run to employ one of the more expensive sweep generators which do have flat output on all bands.

While the material in this article has been concerned mainly with picture amplifiers, the same considerations apply to sound i.f. amplifiers and r.f. amplifiers.

—30—

LET'S USE THAT MICROPHONE!

HARRY C. AICHNER, JR.

IF YOU have a crystal-type microphone whose cartridge has been ruined by extreme heat or by water immersion, you can restore the mike to service by replacing the old unit with one of the inexpensive crystal cartridges now being offered by mail-order radio supply houses for as low as 95 cents. If you like, you could install a dynamic cartridge instead.

Many of these replacement units have very good frequency response, despite their low price. It is indeed a bargain when you can turn a useless microphone into one that performs like its ten-dollar brothers!

You will have very little difficulty making the change, in most cases. Remove the front "grill" of the microphone, unsolder the wires from the old cartridge, and insert in its place the new unit. Be sure that any sponge rubber shock mounting in the old microphone is replaced when installing the new cartridge; this will prevent unwanted microphonic noises.

Also, check to see that the cartridge you contemplate buying is small enough to fit your microphone.

To top off your work, give the mike casing and stand a coat of some grey wrinkle varnish. —30—

Changing crystal cartridge is not difficult.

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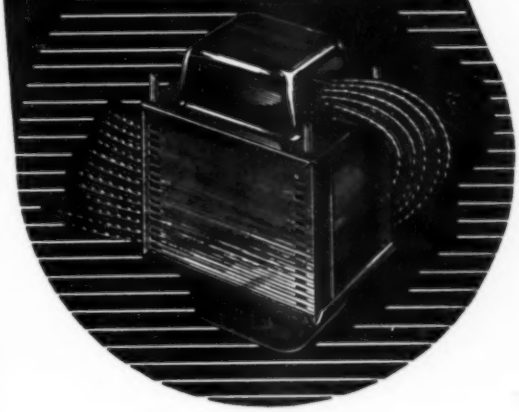

Vertical Blocking - Oscillator Transformer. *Stancor Part Number A-8121.* Exact duplicate *of RCA type 208T2. For generation of 60 cps required to drive grids of vertical discharge tubes.*

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For complete specifications and prices of these and other Stancor TV replacement components, see your Stancor distributor or write for Television Catalog 337.

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4.0	Mfd—	600	vdcw	.59
6.0	Mfd—	400	vdcw	.75
6.0	Mfd—	600	vdcw	.79
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4	11	4	Bakelite	1.17
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18	5	9	Ceramic	1.90

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10	25	.98	1000	25	.98
12	25	.98	1200	225	2.25
15	25	.98	1250	50	1.24
16	50	1.24	1250	150	2.74
22	50	1.24	1500	50	1.24
25	25	.98	2000	25	.98
30	25	.98	2000	50	1.24
50	50	1.24	2500	100	2.25
60	25	.98	3000	25	.98
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The Beginning Amateur

(*Continued from page* 61)

switching except for final amplifier, which uses plug-in type coils; covers all of the bands below 32 megacycles; $190.

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Millen 90811 R.F. Amplifier: Covers 2- to 20-meter bands only, with plug-in coils; output of 70 to 110 watts, depending on mode of operation; uses an 829-B or 3E29 tube in push-pull circuit; intended to be driven by separate crystal oscillator or v.f.o.; power supply not included; designed for incorporation into mobile or fixed transmitters; $33.

McMurdo Silver Model 701 Transmitter: Uses 6AQ5 oscillator, 807 amplifier, and two 6AQ5 modulators for AM modulation; output about 50 watts; covers 6 to 80 meters, with plug-in coils; power supply not included; $37.

Millen 90800 Transmitter-Exciter: Uses 6L6 oscillator, 807 amplifier; output, 25 to 50 watts; all ham bands with plug-in coils; rack panel mounting; modulator and power supply not included; $43.

Millen 90810 Transmitter: C.w. output only, 75 watts, 2-, 6- and 10-meter bands with plug-in coils; uses 6AG7 crystal oscillator, 2E26 multiplier, 829-B final amplifier; rack panel mounting; power supply not included; $70.

Millen 90881 R.F. Amplifier: Covers 10- to 80-meter bands with plug-in coils; can be used with push-pull 812's, 35T's, RK-35's, etc.; rated at 500 watts input; rack panel mounting; no power supply; intended to be driven by a separate exciter; $90.

World Radio Labs. "Globe Trotter": Complete c.w.-AM phone transmitter, 25 to 40 watts input, all bands below 30 megacycles; three bands available with front-panel switching; uses 6L6 oscillator, 807 amplifier; audio, 6SJ7, 6N7, two 6V6; rectifiers, two 5U4G; available in kit form, ready for assembly, $89; factory assembled and completely wired, $99.

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Harvey-Wells TBS-50 Transmitter: Covers 2 to 80 meters; input, about 50 watts; crystal controlled; full bandswitching from front panel; for c.w. and AM phone; uses 6AQ5 oscillator, 6AQ5 buffer, 807 final, two 6L6 modulators; power supply not included, $100.

World Radio Labs. "Globe Champion": Complete 150-watt c.w.-AM phone transmitter; covers 10 to 160 meters; uses 7C5 oscillator, 2E26 buffer, 812-A final; audio, 6SJ7, 6N7, two 6F6, four 6L6; in kit form, ready for assembly, $279; factory assembled and wired, $299; r.f. deck alone, with NBFM, factory assembled and wired, $199.

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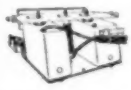
T-32 Microphone with desk or table stand **$2.95**

FCC AUTHORIZES RADIO FOR PRIVATE SERVICE!!!!!

(The FCC announced that effective June 1, any American over 18 years of age is eligible for a 5 year station permit. In the "Citizens" band, neither code test nor technical knowledge is necessary.)

GENERAL ELECTRIC 15 TUBE TRANSMITTER-RECEIVER SET. This brand new 15 tube transmitter-receiver was designed for mobile storage battery powered service. It will operate in the "Citizens" band where no amateur license to transmit is necessary. It's a cinch for any experimenter to connect this unit for 110V AC operation by following the instructions and diagrams supplied, which cover numerous applications, including television. For those intending to use on car or boat, a new dynamotor, exactly as originally supplied, costs only $15.00. Don't fail to write for FREE descriptive bulletin. Order our **RT-1248** for only **$29.95**, or two for **$53.90.**

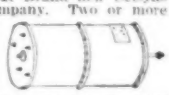
STUPENDOUS VALUE IN 3 SECTION PERMEABILITY TUNER



The entire variable tuning section of a deluxe current model General Motors radio. Amazingly tiny (4x3x2½"), though truly half of a radio. Shielded R.F. sections litz wire wound. All 3 tuned circuits adjustable at both low and high ends of dial. Compact enough to be used to pep up any 2 or 3 gang superhet or 2 gang TRF. Will substitute for entire original tuning system including variable condenser or if desired the original tuning condenser can be connected to these coils, and the coils set to proper inductance (no instruments required), and the set tuned just as before, although much greater sensitivity and selectivity will result. Can be used as a multiple section wavetrap that will cut out undesirable interference as with a knife. If only a little bit better than average results with a slug-tuned wavetrap are necessary, the unit can be split up in a couple of minutes into 3 coils that can be used on 3 different jobs. These coils, super-compact and really hot, can also individually replace any broadcast band RF, oscillator, or 1st detector coil with improvement in results in any set. After seeing one of these units, you'll order a dozen just for general repair or replacement work. Cost the manufacturer several dollars. Your cost—**$1.49.**

$12.95 Takes All Three BIG BARGAINS

SENSATIONAL, FASCINATING, MYSTERIOUS SELSYNS. Brand new Selsyns made by G. E. Company. Two or more connected together work perfectly on 110V AC. Any rotation of the shaft of one Selsyn and all others connected to it will rotate exactly as many degrees in the same direction, following unerringly as if the units were connected together by shafting instead of wire. This is true whether you twist the shaft of the master unit a fraction or a revolution or many revolutions. Useful for indicating direction of weather vanes, rotating directional antennas, or controlling innumerable operations from a distance. Complete with diagram and instructions. **Per Matched pair $4.95.**

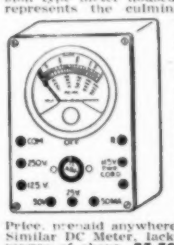


SOS EMERGENCY TRANSMITTER SOS

This is the famous Gibson Girl Transmitter that saved so many lives during the war. It is used as a distress call transmitter on boats and airplanes. The Gibson Girl is the easiest transmitter in the world to operate. No instruction or experience necessary. No external power supply required for operation. It is merely necessary to turn the crank on the top of the transmitter and power is generated and the distress signal is automatically sent out on the international distress frequency. Brand New Gibson Girl transmitter complete with tubes, **$9.95.**

Antenna Kit for Gibson Girl transmitter. This kit was designed to improve the effectiveness of the Gibson Girl Transmitter by increasing the range several times. The kit includes 300 feet of special antenna wire, two balloons for raising the antenna in calm weather, two hydrogen generators to inflate the balloons, a special box kite for antenna erection in windy weather, and a searchlight, powered by the crank operated generator in the transmitter. Complete kit **$9.95.**

Sensational Value in AC-DC POCKET TESTER

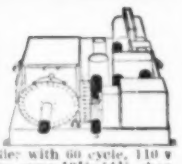


This analyzer, featuring a sensitive repulsion type meter housed in a bakelite case, represents the culmination of 15 years' achievement in the instrument field by a large company specializing in electronic test equipment. Specifications of the AC-DC Model Volt - Ohmmilliammeter: AC Volts—0-25, 50, 125, 250, 1000. DC Volts—0-25, 50, 125, 250, 1000. Milliamperes AC—0 to 50. DC Milliamperes—0 to 50. Ohms Full Scale — 100,000. Ohms Center Scale—2400. Capacity—.05 to 15 Mfd. Total Price, prepaid anywhere in the USA—**$7.00.** Similar DC Meter, lacking the AC operated ranges of above, **$5.50** prepaid.

SUPREME INSTRUMENT CORPORATION Model 592 Speed Tester

The finest multimeter money can buy. "Tops" in quality, accuracy, complete coverage, and speed of operation. 44 ranges at your finger tips. 1 Microampere to 14 amperes. Either 1,000 ohms per volt or 25,000 ohms per volt meter sensitivity, instantly available. 0.1 to 1400 DC volts. ¼ ohm to 50 megohms. No removal of test prods necessary—1 pair pin jacks for all ranges. In beautiful oak case. Regularly $58.95, we are offering these brand new testers for a limited time only for **$49.95.**

RT 1579 with tubes diagram and parts list only $14.95



A three stage, cascade 6S7's and 6F6 output stage high gain, high fidelity amplifier with 60 cycle, 110 v power supply on the same 13⅝x14½ chassis, which is protected by a substantial steel cover over tubes and parts. Made by Western Electric with typical quality components such as a husky power transformer and oil condensers, this unit is obviously intended to give years of trouble-free service with no more need for repairs than a telephone. Disconnecting one wire each, from the special input and output filters, will result in as high a fidelity amplifier as can be obtained.

HI-VOLT ORIGINAL DESIGN VOLT-METER

Hi-Volt Voltmeter test probe. Reads up to 30,000 volts AC or DC with less than 1 milliampere drain. Accurate—dependable—burnout proof. Reads television, neon sign, oil burner ignition, oscillograph and other high voltages. With flexible ground lead and clip, and 14" probe that assures absolute safety to the operator. Complete in itself, no external meters or attachments necessary. A super bargain at only **$11.09.**

"AN" Government approved connectors built to Army-Navy specifications. Most complete stock in U.S.A. Inserts interchangeable between plugs and receptacles.

3100

28-12P
36-7S
36-7P
20-1S
20-1P
32-6P
20-22S
24-10S
28-16S
24-7S
18-2P
24-4S
20-13S
20-9P
18-1P
18-4S
36-15S
22-18P
18-12S
12-5P
20-19S
18-8P
24-5S
24-7P
20-11S
20-3S
20-8S
32-18P
12S-4S
8S-1S
28-16S

3101

14S-5P
16S-6S

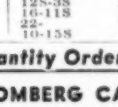
3102

18-10S
18-11S
20-24S
14-3S
16-7S
16-11P
24-11P
24-4S
18-8S
14S-1P
14-3P
16S-4S
16S-5P
16S-10P
18-12P
20-3P
20-8P
3-160
32-6P

3106

32-101S
28-9P
20-19P
10S-2S
12S-4P
20-8S
18-22
20-24P
20-11P
20-3P
18-13S
16S-7P
16S-1P
16-7S
18-11P
20-27S
20-9S
20-9P
12-5S
28-12S
18-4P
32-1S
18-3S
16-11S
16-11P
32-9P
14S-7P
18-1S
18-1P
14S-1S
18-20S
24-7S
18-12P
22-18S
24-4P
24-10P
20-1S
22-14S
22-10P
24-28S
18-11S
20-22P
12-3P
22-30P
22-8S
12S-3S
16-11S
22-
10-15S

3108



12-5P
22-30P
22-8S
12S-3S
16-11S
22-
10-15S
16-11S
22-
22-30P
8S-1S
8S-8S
22-30P
22-14S
12S-4P
16S-1S
18-12S
20-3P
18-5S
18-19
16S-4S
22-2S
22-12S
20-23P
20-23S
18-8S
22-30P
22-14S
12S-4P
14S-2S
16S-1S
18-12S
28-15P
14S-2S
16S-8S—No.1
16S-8S—No.2
28-1P
28-15P

PL Numbers

PL63
PL74
PL103
PL108
PL112
PL121
PL151
PL152
PL160
PL171
PL175
PL181
PL228
PL263

97-5107

28-7S

All Price Quotations Based on Quantity Ordered

TWIN COAXIAL CABLE *at a Sensational Price*

Two No. 12 stranded conductors within a copper shielded, vinyl jacketed, polythylene core. Can handle over 5 KW. of R.F. power. The ideal TV leadin for the most exacting installations such as apartment house antenna systems. Perfect for any twinax use calling for cable within the range of 70 to 95 ohm nominal impedance. Regular price 72c per ft. Your cost **$15.00** per hundred feet. Ask for RG-57U.

RG-59U 72 Ohm Coax. The most popular TV type. Regular price 17c per ft. Your cost 5c per ft. or **$4.50** per C.

AUDIO AMPLIFIER — Brand new. Push-Pull stage triode amplifiers having 2 of the valuable and scarce universal type audio transformers that sell for over $10.00 each. Neat aluminum case, fully enclosed (largest dimension 6 inches). Perfect for intercom system, phone amplifier, mike amplifier or signal tracer amplifier for testing radio sets. A sensational bargain at only.....**$3.40** each

ACRO TELEVISION CHASSIS CRADLE

Pays for itself in a week—Saves and eliminates broken tubes, coils, dials, etc. Cadmium plated steel, finger-tip control. A necessity for Television Service. Your Cost **$4.89**

STROMBERG CARLSON

Power Switching Relay Box. Neat 3½x4x5½" steel case with tight fitting cover finished in Stromberg's unusual beautiful chocolate color crackle finish.....**$1.00**

$7.05 TAKES BARGAIN "C"

(All three items below)

ALUMINUM GEAR BOX 18x8x7 that contains two powerful electric motors and two matched gear trains. 62 gears in all varying in size from ½ to 4 inches in diameter. This unit is readily converted to rotate in beam antenna or any other similar use **$5.00**

SIGNAL CORP INTER-CONNECTOR RELAY BOX 730A

This valuable unit, made by Bell, and more familiarly known by the U. S. Army designation BC616, is encased in a highly polished aluminum case 6½x5½x2½, and contains 150 mfd. of condenser capacity, sensitive relays, resistors, and terminal strips. Order several at the giveaway price of only.....**$1.95**

REMOTE CONTROL UNIT—Aluminum case 4 x 3 x 2 containing 2 potentiometers, triple pole switch, 4 knobs, phone jack, gear mechanism and revolution counter. Including 8 prong Jones connector to fit box.....**$1.39**

Super Special On
ISOLATION TRANSFORMERS $1.95

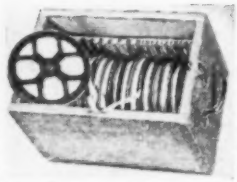
Many adjustments on radios and TV sets especially the AC-DC types, require that the chassis be grounded for stability and successful results. Using an isolation transformer this can be done as a routine procedure on every set on the test bench, ending the hazard of shock and the usual but unwelcome fireworks.

Connected as auto transformers these isolation transformers can also be used to change 110 v to 220 v or the reverse. We do not believe that 100 watt 110 v isolation transformers have ever before been offered at less than double our price of **$1.95.**

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. RN-8, BUFFALO 3, N. Y.

LOOK! Bargains Galore

AT LAST

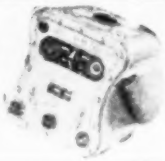


We have available CODE PRACTICE TAPE, which was used for code practice work by the Signal Corps—from slow to fast practice. 15 rolls on 16MM metal reels in heavy wooden slotted case, to be used on Code Keyer. Special... **$9.95**

JENSEN PM SPEAKER

Model P8S—8 inch: 6 to 8 ohm voice coil impedance, 8 watt, with output transformer for push-pull 6V6. List. $12.25. Special..... **$3.95**

GIBSON GIRL



The Emergency Radio Transmitter. Sends SOS signals automatically on 500KC. 150-mile range. No batteries required. Has hand-driven generator, tubes, wire; all packed in knapsack. It's only..... **$2.95**

IDENTIFICATION MODEL
PLASTIC AIRPLANES

Italian Macchi	German Dornier
Italian Reggine	German Heinkel
Italian Savoia Marchette	German Messerschmitt

Above set of 6—Italian—German.....$2.95
Russian Bomber, only.....$1.19
Above set of 7.....$3.98

CONDENSERS

G.E.	.35MFD....	5000V	....$1.50
G.E.	1MFD....	2000V	....$ .75
Sprague ..	1MFD....	3600V	....$ .95
Sprague ..	3MFD....	4000V	....$5.95
Sprague ..	1MFD....	1000V	....$ .39
Sprague ..	.5MFD....	1500V	....$ .29
Aerovox ...	.02MFD....	8000V	....$1.49
Aerovox ...	2MFD....	3000V	....$2.95
C.D.	.5MFD....	200V	....$ .19
Solar	.25MFD....	2000V	....$ .39
Industrial	8x8x4MFD....	650V	....$1.59
C.D.	2x.01MFD....	600V	...bathtub...$ .19
C.D.	2MFD....	1000V	....$ .95
C.D.	2x.02MFD....	600V	...bathtub...$ .19
G.E.	.15MFD....	4000V	...oil filled...$ .98
Solar	.16MFD....	200V	...oil filled...$ .98
Mallory ..	2MFD....	2000V	...oil filled...$1.95
Aerovox ..	1MFD....	1000V	...oil filled...$1.19

STANDARD RACK CABINETS

Heavy gauge steel, gray crackle finish; panel opening 19" wide, 27" high..... **$12.95**

WATTHOUR METERS

GE I-16 single phase 60 cycle 115-120 volt 5 amp—two wire—glass case..... **$6.95**
WESTINGHOUSE—metal case—115-120 volt 60 cycle—5 amp. single phase..... **$4.95**
SANGAMO — metal case — 115-120 volt 60 cycle—5 amp. single phase..... **$4.95**
Sangamo 10 and 25 amp..... **$5.95**

EICO
EMC and approved
Kits and complete test equipment.

SELSYN MOTORS

50V, 50/60 cycles. Can be used to turn small beam antenna or as indicators. 3½" diameter x 5½" high. Two can be used in series on 110V. AC. Brand New. Pair..... **$4.95**

TRANSMITTER CONTROL BOX — Type C-30/ARC-5. Mfg. by W.E. Size 4½x3x3". Equipped with slide fasteners, has 7 push button switches, 1 control switch and two multicontact jacks..... **$1.49**

FRENCH TYPE PHONE—TS-13 Hand-Set—butterfly switch on handle, 6 ft. cord with PL55 plug for earphone and PL68 for mike..... **$3.95**

Dynamic hand mike and earphone, with push-button switch and JK38 double jack; 6 ft. cord. Special..... **$.29**

Prompt Delivery—25% deposit required on C.O.D. order. Shipped F.O.B. New York—Write Dept. RN12

MICHAEL STAHL, INC.
39 VESEY ST.
New York 7, N. Y., WO 4-2882

The Stancor ST-202-A c.w. transmitter kit will handle an input of 125 watts.

circuits to attenuate spurious emissions of the multiplier stages and a harmonic attenuating network in the antenna coupling circuit; $575.

Collins 30K-1 Transmitter: Deluxe 500-watt outfit; exciter unit is placed next to receiver, for remote operation of transmitter proper; covers 10 to 80 meters; for c.w. and AM phone; eleven tubes; main floor unit is 5 ft., 6½ inches high, weighs about 600 pounds; rugged deck type construction; (front view of unit is shown on Page 59); $1450.

There are also some lesser-known transmitters and kits available in various power ratings.

(To be continued)

SIMPLE BIAS SUPPLY

By OTTO L. WOOLLEY, WØSGG

THIS bias supply furnishes both operating and protective bias voltages. It is simple, foolproof, and requires only two parts—a VR tube and a condenser. No external power source is required to energize this supply, and the bias voltage it produces is constant.

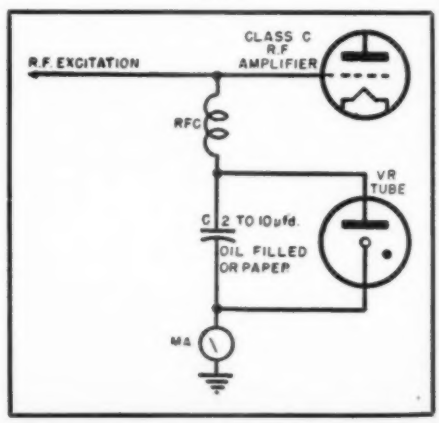
A moment's study of the schematic (Fig. 1) will reveal how this system operates. When excitation is applied to the Class C amplifier stage the rectified grid current flows through the VR tube, causing it to ignite. This action causes a voltage difference equal to the rating of the VR tube to be impressed across the condenser, charging it. This voltage difference is also the operating bias voltage. When excitation is removed, the condenser will discharge through the VR tube until the voltage is reduced to the point where the tube is extinguished, after which no further discharge can take place. This remaining charge on the condenser now acts as protective bias. The length of time the condenser will remain charged depends on the leakage in the associated circuit and the size and quality of the condenser. With a good quality, 4 μfd. oil-filled condenser in a clean circuit, the residual charge after 24 hours is sufficient to hold the plate current of a medium power rig to a safe value.

Any number of different voltages may be obtained by the use of various tubes. Voltages of 75, 90, 105, and 150 are obtained through the use of single tubes. By using a combination of the above tubes in series arrangement almost any required voltage may be had.

Most of the VR tubes will pass up to 40 ma. within ratings. In the event it is necessary to pass more than this amount of current the tubes may be paralleled, although there is a good chance that some difficulty may be experienced in getting all the tubes in a multiple setup to fire. In some cases a 50-ohm resistor in series with each tube will be helpful. If a number of tubes are on hand, substitutions may be made until tubes of equal operating characteristics are found.

One precaution must be observed with this type of bias supply. Always apply excitation before or with plate voltage to the final when the rig is initially put in use, or after protracted rest periods when the condenser may be discharged. —30—

Fig. 1



FAST SERVICE RADIO TUBES at Lowest Prices

AM, FM, TV—Tremendous Selection of All Types—ORDER TODAY!

29c ea.

1T4 1U4 3A4 3Q4 6S8GT 61A 4A6G 6A3 6C4 6F8GT 6SD7GT 10 12A 14X7 39/44 47 50 71A 112A 182B

FREE! $20.00 List Value Cornell-Dubilier, Mallory, Aerovox, Sprague, Solar. Filter Condensers—ten fast moving filters FREE with each 100 tubes.

183 25S 25Z6GT 482B 483 1A4 1A4P 1A6 1B5 1D5GT 1D7 1D8GT 1F4 1F5G 1G4GT 1G6GT 1H4G 1H6GT 1J6G

29c ea.

39c ea.

1C5 1C6 1L4 1R5 1S5 1U5 2A5 2A7 3V4 5U4G 5W4GT 5X4G 5Y3GT 5Y4G 5Z3 6AC4 6AC5 6AC5GT 6AG5 6AK5 6AL5 6AL6 6AQ5 6AT6 6AU6 6A8G 6A8GT 6B6 6BA6 6BD6 6BE6 6BH6 6BJ6 6C5 6C8G 6D6 6F5GT 6F6GT 6G6 6H6 6H6GT 6J5 6J5GT 6J6 6J7G 6J7GT 6K6GT 6K7GT 6K8GT 6P5GT 6SA7GT 6SC7GT 6SG7 6SG7GT 6SH7 6SJ7 6SJ7GT 6SL7GT 6SK7GT 6SN7GT 6SQ7GT 6SR7 6U6G 6U6GT 6U7G 6U7GT 6V6GT 6W4 6X4 6X5GT 6Z4 12A8GT 12AT6 12AU6 12AU7 12AX7 12BA6 12BA7 12BE6 12F5GT 12H6 12J5GT 12J7GT 12K7GT 12K8GT 12S8GT 12SA7GT 12SF5 12SF7 12SH7GT 12SJ7 12SN7GT 12SR7GT 1619 1629 (eye) 2050 2051 24A 25L6GT 25X6 30 31 32 33 34 35 35B5 35C5 35W4 35Z4GT 35Z5GT 35Z6GT 36 37 38 39 46 50B5 50Y6 51 VT-52 58 87 88 75 76 77 78 80 85 89

49c ea.

OZ4 1A5GT 1A7GT 1C7G 1H5GT 1LA4 1LE3 1N5GT 1P5GT 1Q5GT 1T5GT 1V 1C5GT 2A3 2B7 5V4 5Z4 6A8 6AC7 6AV6 6B4G 6BA7 6B8 6C6 6D8 6D8G 6F5 6F8G 6K7G 6R7 6SF5GT 6Q7GT 6T7G 6T8 6U7 6W7G 6Y6G 6Z7G 7A4 7A7 7B6 7E5 7E6 7E7 7F7 7G7 7H7 7J7 7L7 7N7 7Q7 7S7 7T7 7W7 18Y 12A7 12AT7 12C8 12J5 12Q7GT 12SG7 12SJ7GT 12SK7GT 12SL7 12SQ7GT 12Z3 14N7 19T8 20 32L7GT 35/51 35L6GT 36 40 41 42 43 50L6GT 53 84/6Z4 117Z3 VR150 XXL

49c ea.

59c ea.

1B3 1AB5 1AD5 1LA6 1LB4 1LC5 1LC6 1LH4 1LN5 1S4 2C34 2V3G 2X2 25Z5 35Z3 3LF4 3Q5GT 3S4 50A5 6A7 6B7 6BF6 6BG6G 6J8G 6L6G 6L6 6S7G 6SU7GT 6U5 7C4 12A6 12BF6 14H7 45 70L7GT 81 83 117Z6GT 807 9001 XXB

Above prices are for 50 tubes or more—may be assorted. Less than 50 tubes, 5c per tube extra. Individually boxed—Standard factory guarantee.

50L6, 35Z5, 12SK7, 12SQ7, 12SA7 . . . 5 tubes for $1.95

Miniature tubes 12AT6, 12BA6, 12BE6, 35W4, 50B5, 5 tubes for $1.59

1R5, 1S5, 1T4, 3V4 Battery Tube Special 4 tubes for $1.29

SPEAKERS

Best quality Alnico 5 PM Speakers.

	10 or more Each	Price Each
5"-95c-		$1.05
2½", 3", 4"—95c - $1.05		
6"	$1.49	$1.59
8"	2.95	3.25
10"	4.25	4.50
12"	4.95	5.95

IF TRANSFORMERS

Standard Replacement
Regular size . . . . . ea. 29c
Midget . . . . . ea. 39c

4 PRONG VIBRATORS—VERY BEST BRANDS

Standard replacement—Sensational Value . . . . . $1.29 ea.

OCTAL SOCKETS . . . . . 10 for 49c

CRYSTAL CARTRIDGE

Standard replacement crystal cartridge. Each $1.39

10BP4 TV Picture Tube . . . . . $17.95 each
12LP4 . . . . . $24.95 each

VOLUME CONTROLS

VERY BEST BRANDS	10 or more Each	Price Each
½ meg. with switch—long shaft	29c	35c
2 meg. for battery sets—DPST switch, long shaft	29c	35c
½ meg., 1 meg., or 2 meg., long shaft, less switch	15c	19c

BY-PASS CONDENSERS

100 Condensers assorted in package $5.95

.001 mfd. 600 V. . . . . ea. 6c
.002 mfd. 600 V. . . . . ea. 6c
.005 mfd. 600 V. . . . . ea. 6c
.01 . . . . . ea. 7c
.02 . . . . . ea. 7c
.05 . . . . . ea. 8c
.1 . . . . . ea. 9c

400 VOLT BY-PASS CONDENSERS

.2 mfd. . . . . ea. 6c
.25 mfd. . . . . ea. 10c
.5 mfd. . . . . ea. 15c

BUFFER CONDENSERS

.005 mfd. 1600 WV
.008 mfd. 1600 WV
.01 mfd. 1600 WV . . . . . 15c ea.

VARIABLE CONDENSERS

Two gang for superhet Standard ¼" shaft 69c

CONDENSERS

OUTPUT TRANSFORMERS

For 50L6, etc. 39c ea.

For 6V6, 6F6, 3Q5, etc. . . . . 45c ea.

UNIVERSAL OUTPUT TRANSFORMER SPECIAL:
Up to 8 watts to any speaker . . . . . 98c ea. (while they last)

PILOT LIGHTS—100 BULBS $4.90

1 box of 10 bulbs 54c

No. 40 6-8 V .15 Amps. | No. 46 6-8 V .25 Amps.
No. 41 2.5 V .50 Amps. | No. 47 6-8 V .15 Amps.
No. 44 6-8 V .25 Amps. | No. 51 6-8 V .20 Amps.

6-Ft. LINE CORDS

Good Rubber with plug. 10 for . . . . $1.25 | Underwriters' Approved. 10 for . . $1.69

SELENIUM RECTIFIERS

Standard 100 mil. Each 79c

PUSH-BACK WIRE 100 ft. rolls . . . . . 39c each

Visit Our New Dealer Display Rooms

PREMIER RADIO TUBE COMPANY

551 West Randolph St.
Chicago 6, Illinois
Phone: ANdover 3-1590

"Your Tube Source Since 1926"

To speed up delivery, please sign your order and your remittance with the same name.

FILTER CONDENSERS

Very best brands. Fresh stock

450 Working Volts

8—450 V . . . . . ea. 21c
10—450 V . . . . . ea. 24c
10—450 V w/20-20—25 V . . . . . ea. 29c
15—450 V . . . . . ea. 29c
20—450 V . . . . . ea. 39c
30—450 V . . . . . ea. 49c
30—450 V with 20-20—25 V . . . . . ea. 29c
8-8—450 V . . . . . ea. 39c
10-10—450 V . . . . . ea. 43c
20-20—450 V . . . . . ea. 49c

150 Working Volts

15-15—150 V . . . . . ea. 29c
20-20—150 V . . . . . ea. 29c
20-20-20—150 V . . . . . ea. 39c
30-30—150 V . . . . . ea. 39c
40-20—150 V . . . . . ea. 39c
40-30—150 V-30-20-25 V . . . . . ea. 39c
40-40—150 V . . . . . ea. 39c
40-40—150 V-25-25 V . . . . . ea. 39c
50-30—150 V . . . . . ea. 39c
50-50—150 V . . . . . ea. 39c
60-60—150 V . . . . . ea. 39c
15—150 V . . . . . ea. 21c
16—150 V . . . . . ea. 23c
20—150 V . . . . . ea. 25c
30—150 V . . . . . ea. 29c
40—150 V . . . . . ea. 29c

25 Working Volts

10—25 V . . . . . ea. 16c
20—25 V . . . . . ea. 16c
25—25 V . . . . . ea. 16c
100—25 V . . . . . ea. 16c
20-16-16—350 V Sprague type . . . . . ea. 39c
25-25—150 V-200-10 V . . . . ea. 39c

Rated accounts—10 days—all others 20% deposit with order, balance COD. Minimum order $5.00. All shipments FOB Chicago. Prompt attention paid to foreign orders. ORDER TODAY. Our parts and tubes are warranted to be 100% replacements for the prototypes in the listings above. Satisfaction Guaranteed.

NEW PRECISION ELECTRONICS
SIGNAL TRACERS

Write for literature and name of your nearest Jobber

PRECISION ELECTRONICS, Inc.
641-643 MILWAUKEE AVENUE
CHICAGO 22, ILLINOIS

SIGNAL TRACER SPECIALISTS

It's the Biggest News in PLAYBACKS!

REK-O-KUT's
3-SPEED TURNTABLE
with Instantaneous Speed Selector

3 SIMPLE OPERATIONS

- **78 r.p.m.**—slide shift-lever to left
- **45 r.p.m.**—slide shift-lever to right
- **33⅓ r.p.m.**—press selector button down, slide shift-lever to right

NOISE LEVEL: — 30 db minimum
MOTOR: 4 pole induction, with starting switch
TURNTABLE: Cast aluminum
SPEEDS: Regulated by adjustable stops
DIMENSIONS: L. 15"; W. 12"

Model LP-743 only **$49.95** net

REK-O-KUT CO., Inc.
38-01 Queens Blvd., Long Island City, N.Y.

"Nuts and Bolts"
(*Continued from page* 41)

educational and nationally important programs too. As far as the payments go, we can arrange them just about any way you like. You may pay ten or twenty per-cent down, and the balance over up to eighteen months.

"And like most people, you'll want your set about as soon as you can get it. Let me check my installation schedule here. Mmmm. Well, Sir, we're in a bit of luck. I find we can deliver and install the set either Wednesday morning or Thursday afternoon. Which would you find most convenient?"

Thus, this dealer, instead of confusing Mr. and Mrs. Black with technical terms and details, appealed to their buying motives and made the sale!

Before closing, let's briefly summarize the points that every salesman should keep in mind to avoid "nut and bolt selling."

1. Remember, the average prospect is interested in buying a television receiver only because of the pleasure, entertainment, enjoyment, and education it can bring him. To him, it is a marvel of modern science, that can bring all kind of programs into his home, but he has little desire to know, and is generally incapable of understanding, how it does this for him.

For example, suppose you are presenting the advantages of a console model over a table model from the point of view of tone quality. The "nut and bolt" salesman would say, "Yes, Mr. Black, this speaker has a 12" PM speaker with a 13-ounce *Alnico* V magnet, and a much larger baffle. It will give you more power and better tone quality."

On the other hand, the trained salesman would say, "As you can see, Mr. Black, this receiver has a much larger loudspeaker and is in a much heavier cabinet. As a result, the speech and music that comes through will be much more beautiful and more realistic than with the smaller set. In fact, with this set, you'll hear the music reproduced so faithfully, you'll feel the actors and the musicians are right in your own home, putting on their performance for your personal benefit!"

2. If you do feel obliged to explain a purely technical feature, translate it into terms of *benefits* to the buyer as early in your explanation as possible. For example:

"This set also has an automatic frequency lock circuit, which will prevent the picture's being thrown off the screen because of interference from autos or other sources of electrical disturbance. It means that you will be able to enjoy your television without interruption and with much less eyestrain."

3. You will occasionally come across

STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233), OF RADIO & TELEVISION NEWS (RADIO-ELECTRONIC ENGINEERING EDITION), PUBLISHED MONTHLY AT CHICAGO, ILL., FOR OCTOBER 1, 1949.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, William B. Ziff, 185 N. Wabash Ave., Chicago 1, Ill.; Editor, Oliver Read W9ETI, 185 N. Wabash Ave., Chicago 1, Ill.; Managing editor, Wm. A. Stocklin, 185 N. Wabash Ave., Chicago 1, Ill.; Business manager, A. T. Pullen, 185 N. Wabash Ave., Chicago 1, Ill.

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3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (Modern Woodmen of America, Rock Island, Illinois.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was..... (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.)

A. T. PULLEN, Business Manager.

Sworn to and subscribed before me this 22nd day of September, 1949.

[SEAL]

ALBERT H. WITTHOFT, Notary Public.
(My commission expires April 9, 1950.)

the technically-minded and technically-trained prospect. When you do, you will naturally want to meet him on his own ground and answer his questions intelligently and honestly.

On the other hand, don't make the mistake of thinking he is only interested in the technical features. Even he is thinking of the pleasure, enjoyment, and entertainment the receiver will mean to himself and to the members of his family.

Therefore, you will do well to conclude each of your technical explanations with a direct appeal to his desire to enjoy the benefits that the particular features under discussion can bring him.

For example, you might say, "Yes, Mr. Thompson, this receiver has the latest-type ratio detection and I know it will give you a great deal of personal satisfaction to know that you and your family will enjoy better reproduction of speech and music because of it."

—30—

QUICK CHECK FOR PICTURE TUBE CURRENT DRAIN

By JACK NAJORK

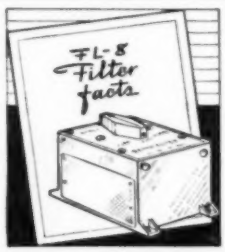
OCCASIONALLY, in servicing or setting up TV receivers using the "flyback" type of high-voltage power supply, no raster can be obtained on the screen of the picture tube even though high voltage is present. This may be due to several causes, including a defective picture tube. Since a replacement picture tube is not always available for test purposes, the following check can be made to determine if the picture tube is drawing current.

While observing the filament of the high-voltage rectifier (usually a 1B3/8016), quickly rotate the "Brightness" control from minimum to maximum. If the filament of the rectifier dims momentarily when this is done, the picture tube is drawing current. The dimming occurs because of the inherently poor regulation of this type of power supply.

A defective or improperly adjusted ion trap usually causes this condition of current drain, but no raster. An ion trap is used on the neck of most conventional ten- and twelve-inch magnetically deflected picture tubes.

—30—

"At a time like this—YOU FLY A KITE!"



AN "FL-8 FILTER FACTS" BOOKLET FREE WITH EACH PURCHASE OF AN FL-8 FILTER!

An 8-page booklet devoted entirely to the FL-8. Complete circuits—selectivity curves—break-down views of interior components, coil inductances and resistances. Shows how to get best results from the FL-8 as-is, also how to convert this unit to many other types of useful filters for transmitters and receivers. High-pass, low-pass, peaked. A gold mine of FL-8 data prepared for us by Clayton F. Bane, W6WB. Simple language—no math. You need an FL-8 to improve your selectivity and s-n-r ratio—"Filter Facts" assures full utilization of this effective filter.

Combination offer . . . FL-8 Filter and Booklet.....$2.98
Booklet alone . . . (prepaid in U.S.A.).....50

HOT SPECIAL ON OIL CAPACITORS

8 mfd., 1000V, oil-filled. Made by Aerovox. Rect. case grey finish, complete with mounting brackets. $1.95 ea.; 5 for $8.95
4 mfd., 600V, oil-filled. Round case, upright single-hole mounting. With mtg. hardware.....95c ea.; 5 for $3.75

HEAVY-DUTY FILTER CHOKE

A hermetically sealed unit, conservatively rated at 10 henries @ 200 ma. Has hum-bucking tap. Steel cases—ONLY $1.98 each.

COMPLETE POWER SUPPLY—COMBO OFFER

1—Filter choke....(as above).....
2—4 mfd., 600V condensers, Oil-filled
1—Power transformer. Pri. 110V, 60 cy. AC. Sec. 730V. AC. CT. @ 200 ma. 5V @ 6A. 6.3V @ 8A.
1—5U4G rectifier tube .....
All of the above items.....only $6.95

HANDSET HANGER

Accommodate all makes and models, (Kellogg, W-E, American etc.) Beautiful, cast aluminum shell finished in rich black wrinkle. Felt facing protects handset. Provision to fasten directly to desk or to telephone equipment. An extremely useful, well-made item .....$1.95 ea.

TS-10 Sound Powered Handsets
Brand New! $16.95 per pair
RM-29A TELEPHONE: Brand New .....$12.95 ea.
EE-89A TELEPHONE REPEATER: New $9.95 ea.

LINE-FILTER KIT

Supplied with all necessary parts including choke, capacitors, etc. Mounts in an attractive stainless-steel box which comes completely drilled. Diagram is furnished. Anyone can quickly assemble the parts into an effective line filter that will handle 30 amp. (max.).....only $1.95

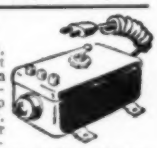
Power Supply for Any 274-N Receiver

Here it is—at last! Just plug it into the rear of your 274-N RECEIVER . . . any model! Complete kit, and black metal case, with ALL parts and diagrams. Simple and easy to build in a jiffy. Delivers 24 volts plus B voltage. No wiring changes to be made. Designed especially for the 274-N receiver. All necessary parts for conversion of rest of receiver also included. ONLY $7.95. TUNING KNOB for 274-N Receiver, 59c ea.

SENSITIVE, 6500 OHM SP-ST RELAY

Made by Automatic Electric Co. Normally-open, wiping contacts, relay is midget size and very light weight. Closes on 2 ma. Ideal for models and control. Only $1.25 ea.; 10 for $10.00

CONDENSER TESTER



● One of our best sellers! Useful, versatile laboratory item, in kit form. Simple, and easy to build in less than an hour. Checks condenser leakage and continuity up to 8 megs. Will test any paper, electrolytic, mica or oil capacitor from 50 mmf. to 50 mfd. Self-contained power supply and neon bulb indicator with socket and bezel. Drilled metal cabinet. Complete instructions and diagrams included with each kit. Only $4.85.

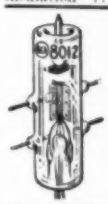
HARRIS SHOCK MOUNTS LORD

LORD 8 lb. 7c ea., 8 for 45c; $3.00 per C
LORD 10 lb. 15c ea., 8 for 98c, $7.50 per C
HARRIS 8 lb. 8c ea., 8 for 45c, $4.00 per C
HARRIS 12 lb. 16c ea., 8 for $1.05, $9.00 per C.

HI-LEVEL NEGATIVE PEAK CLIPPER! 836 RECTIFIER TUBES

Use an 836 high-vacuum, high-voltage rectifier tube. Ideal for "clippers"—no "hash" troubles. Same tubes also used to replace 866's in normal, high-voltage rectifier applications.
Rock-bottom price on a really "hot" tube 2 for $1.10

High-voltage Filament Transformer for "Clipper" or Rectifier applications.
Pri. 110V, 60cy. AC. Sec. 2.5V @ 10A, 10,000V insulation .....$2.76 ea.



RCA 8012 VHF TRIODE

TANTALUM plate and grid! 35 watts output, 40 watts plate diss. Use as osc. or amp. at full ratings up to 500 mc! C.T., 6.3V filament reduces fil. lead inductance. ALL BRAND NEW! Normally sells for $14.50, large quantity purchase permits our extremely low prices of $1.50 each. 4 for $5.00.

PROTECT COSTLY TUBES AND EQUIPMENT AGAINST OVERLOAD!

Here's a buy on a fast-acting, reset-type circuit breaker. Designed to trip at 220 ma; cinch to shunt for higher currents. Excellent construction—panel or deck mount—use also as combo on-off sw. and bkr. Priced low because of quantity purchase .....89c ea.

SCOOP!

6L6 METAL..90c ea. Four for $3.40
6L6 GLASS..79c ea. Four for $3.00
BRAND NEW . . . STANDARD BRANDS

W-E 708A GROUNDED-GRID TRIODE

High hop on UHF receivers. Fine signal-noise ratio. Grid, (shell) bolts direct to chassis with ring. Only $1.95 ea. or 4 for $6.00.

SPECIAL PURCHASE—BC-624 RECEIVER

A few of these well-known UHF receivers from the SCR-522. Complete with tubes. Good, electrical and mechanical condition.....$14.95 ea.

INCREASED RECEIVER OUTPUT TO HEADPHONES!

Use these matching transformers to obtain big increase in output when using hi-imp. phones with the average receiver. (300-600 ohms.) Use also with FL-8 filters for greatly improved results. Hermetically sealed, plated brass case, good LF response. Imp. ratio approx. 10:1.
An excellent value at.....95c ea.
Special hi-ratio for 75A receivers.....95c ea.

CHECK THESE C-R TUBE VALUES!

3CP1, 3" C-R tube. Green, med. persist. screen $2.95
3DP1A, 3" C-R tube. Green, med. persist. screen, 14 pin base for oscilloscope use. A real buy at only ..... 2.50 ea.
3FP1, 3" C-R tube, Green, med. persist.... 2.95 ea.
5MP1, 5" C-R tube, Green, med. persist.... 2.50 ea.
5NP1, 5" C-R tube, Green, med. persist. screen ..... 2.50 ea.

LOOK! NO HANDS!

This mike leaves both hands free for mobile QSO's. Fastens to operator by simple snap strap. Western Electric button assures best quality obtainable from any carbon mike. Adjustable. Double action sw. operates push-to-talk or holds on. BRAND NEW only $1.75 ea. POSTPAID in U.S.A. and CANADA.

HY-615 UHF TRIODE

6.3V filament, 4.5 watts output. 98c each or 4 for $3.00.

HY-114B UHF TRIODE

Ideal for battery portable xmtr. 2 watts output at UHF. 98c each or 4 for $3.00.

★ 4-HOUR MAIL-ORDER SERVICE. WE SHIP ANYWHERE.
20% DEPOSIT MUST ACCOMPANY ALL ORDERS, BALANCE C.O.D.

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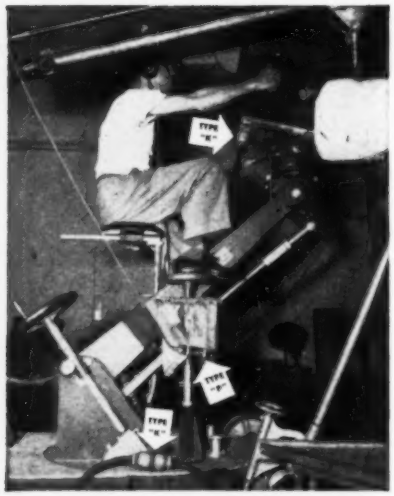


PLUG-IN

WITH

Cannon Plugs

. . . be assured of "good connections." That's why television stations, for instance, use Cannon Electric Type K, P, and other series for cameras, microphones and transmission equipment that *must not fail.* Shown above is a camera at KTLA—*Hollywood.*

Cannon Plugs are available through a network of radio parts dealers all over the U. S. A. Buy them from Seattle Radio Supply in *Seattle;* Cooper Sound Equipment in *Cincinnati;* Radio Inc., in *Oklahoma City;* Van Sickle Radio in *St. Louis;* Offenbach-Reimus in *San Francisco;* and over 400 other distributors.

DESK SIZE CHARTS—FREE

Two desk charts of Type "AN" and "K" insert arrangements shown half scale are available on request. Address Catalog Dept. L-228 at factory.

Cannon Electric Development Company, Division of Cannon Manufacturing Corporation, 3209 Humboldt St., Los Angeles 31, California. Canadian factory: Toronto. World Export: Frazar & Hansen, San Francisco, New York, Los Angeles.

SINCE 1915

CANNON ELECTRIC

What's New in Radio

(*Continued from page 87*)

tated to any of 24 commonly used angles.

Bulletin A-1055, containing additional information on these models, will be sent on request to the company.

TV-WIRE RECORDER COMBINATION

The new *Lear, Inc.,* model, WD-302-TV, just announced by the Los Angeles office of the Grand Rapids, Michigan,

firm, combines TV reception with a wire recorder and AM-FM radio facilities.

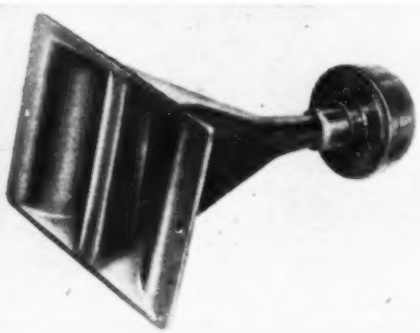
Available with mahogany or blonde finish cabinets, the new design will incorporate the *Lear* wire recorder with a *Stephens* 15-inch Trusonic speaker. There are 52 tubes plus the rectifiers included in the unit, and the TV tube is the 12-inch size. A picture enlarger is built into the cabinet.

Besides these unique combinations, the new model is equipped with a long-playing record changer, making it one of the first of its kind on the present market.

UNIVERSITY TWEETER

Tweeters which employ an entirely new principle of horn design have just been introduced by *University Loudspeakers, Inc.,* 80 South Kensico Ave., White Plains, New York.

Available in two different watt sizes, the Models 4408 and 4409 feature a cobra horn constructed of a one piece aluminum casting scientifically flared to provide maximum horizontal dispersion. An integral cast fin is provided to increase the horizontal spread.



Bakelite diaphragms, Alnico 5 magnets, aluminum voice coils, and feather-weight phenolic varnishes all contribute to wide response, high conversion efficiency, and power handling capacity, according to the company.

Used with an efficient cone speaker, the Model 4408 handles up to 15-20 watts of program material while the Model 4409 will carry up to 25-40 watts undistorted output.

Complete details are available on request. Address inquiries to *University Loudspeakers, Inc.,* 80 South Kensico Ave., White Plains, N. Y.

ICA VIDEO ANTENNA

Insuline Corporation of America, Long Island City, New York has introduced the "Bi-Con" antenna for television installations.

This unit, of the modified conical type, features separate high-frequency and low-frequency reflector elements. Designed to withstand long exposure on rooftops without reduction in electrical performance, this unit is available in two forms, the basic two-element antenna and a stacked array of two units with half-wave spacing and a suitable matching stub for reception in fringe areas.

DYNAURAL PREAMPLIFIER

A professional-type preamplifier for magnetic-type pickups has been recently introduced by *Hermon Hosmer Scott, Inc.,* 385 Putnam Avenue, Combridge 39, Massachusetts.

This new unit, which incorporates the new *Scott* Dynaural noise suppression circuits, is now available for high fidelity enthusiasts at a new low price. It incorporates wide range circuits as

well as a variable turnover control to compensate for different recording characteristics, and an adjustable distortion filter.

The preamplifier is completely remote controlled and the controls may be mounted at any convenient location on a cabinet or custom installation.

TURNER MODEL 77

The *Turner Company* of Cedar Rapids, Iowa is currently marketing the re-designed Model 77 cardioid-type microphone which has been designated the "Tru-Cardioid."

The case is finished in gunmetal gray with a chrome plated screen. The interior retains the feature of a combination circuit using both velocity and dynamic type generators while the new design has further improved the performance.

The Model 77 has been engineered with a wide range pickup at the front

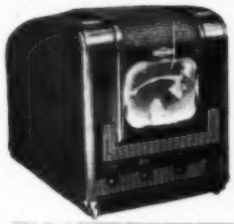
and a sharply attenuated output at the rear with approximately 15 db. discrimination between front and rear at all frequencies. The unit's pickup pattern reduces feedback to a minimum and practically eliminates interference from extraneous sound arriving from the rear of the microphone. Response is substantially flat from 60 to 10,000 c.p.s. Output is rated at 62 db. below 1 volt/dyne /sq. cm. at high impedance. A built-in switch provides a choice of 50, 200, 500 ohms, or high impedance. Complete specifications are available from the manufacturer.

NEW RECORDER UNIT

The *Twin-Trax Division of Amplifier Corp. of America*, 398-2 Broadway, New York, has just announced the availability of a new continuous-play magnetic tape recorder.

This new unit eliminates the usual continuous tape loop with its attendant difficulties, such as complicated threading, critical tape splicing techniques, and limited message length. Continuous repetition in this instrument, the Model 810-DV, is achieved through double reversal of standard magnetic tape. Half of the message is recorded on one sound track in forward tape travel and the other half on the second sound track in reverse tape travel.

The instrument is self-contained but a connection is provided for playback through any p.a. system. —30—



HERE'S VALUE THAT CAN'T BE DUPLICATED

R.C.A. LICENSED TELEVISION RECEIVERS

Large 52 sq. in. Complete with all tubes including 10" picture tube and hand-rubbed mahogany cabinet.... **$129.50**

CUSTOM WIRED CHASSIS

#630 Jr. with RCA tuner. A 16" screen with pictures 150 square inches. Complete with 16" tube.....$169.50
Table Model Cabinet for above. 49.50

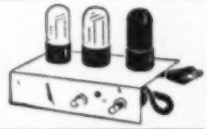
TV COMPONENTS

RCA Front End.....$29.50
16" Power Transformer.... 6.95
300 ohm twin lead-in 100 ft. $1.65. 1000 ft..... 10.95

ALL CHANNEL INDOOR TABLE TOP 3 SECTION TV ANTENNA **$2.95** Lots of 3, $2.75

3 TUBE PHONO AMP. **$1.95**

Completely wired with tone and volume controls.....
Set of tubes for above.....$1.25



3 SPEED CHANGERS

Webster 346 .....$29.25
Webster 356 ..... 33.25
3 Speed Phono Motor $5.95
Stand. Make 78 R.P.M. Phono Motor 2.25
Nat. Adv. Pickup..... 1.79
Nat. Adv. 3 Speed Pickup.. 4.95
Cartridge N-7 $1.39 ea. per 6 8.00

SEEBURG 2 POST CHANGER

(Automatic shut-off) V.M. #400 ..... } **$14.95**
Webster #70 .....$19.95

Cartridges, Astatic $1.49 ea. per 6 8.75
Nationally Advertised FP 8 mfd 475 V. 29c ea..per 10 2.00
Nationally Advertised FP 15 mfd 450 V. 29c ea..per 10 2.00
Output Transformer 50L6 35c ea. .....per 10 3.00

Minimum Order $3.00—All Prices F.O.B. New York
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PHOTOCON SALES

SYCAMORE 4-7156
PASADENA 7, CALIF.

DECEMBER SPECIALS

ARC-1 AIRCRAFT TRANSMITTER-RECEIVER—10 channel RT18/ARC-1, Excellent Condition with tubes.....$695.00

HS-23 HEADSET—BRAND NEW 8,000 ohm with ear pads.....$2.45
HS-33 HEADSET—With ear pads..... for 1.29
HS-30 HEADSET—Complete with matching transformer, 6' cord & PL 55 Plug, NEW 1.95
HS-30 HEADSET ..... .95
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T-32 DESK MIKE...USED $1.95; NEW 3.00

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MC6—1½ Watt Trans.-Recr., tubes, crystal, battery case, antenna.....$31.50
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METER RECTIFIER, full wave midget Selenium 10 volts, 30 ma. ..... .29
APN-1 ALTIMETER, Complete.....NEW 34.50
I. F. Transformer—1st, 2nd or 3rd, from SCR-522, 12,000 K.C. Iron Core tuning, can be tuned to television I.F. Frequency by removing padder cond. .....each .35
3 for 1.00

PE-103 DYNAMOTOR POWER SUPPLY, COMPLETE with dynamotor, filter, relay unit, battery cables, and shock mount. Part of SCR-284. BRAND NEW $19.50

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Combination BC-620 and PE-120..Both for 14.95

WESTON ELECTRICAL TACHOMETER METER, Model 545 for use with Model 724 magneto. Speed 0-2,000 R.P.M. Ratio 2:1 .....BRAND NEW $17.50
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SCR-522 TRANSMITTER-RECEIVER, with tubes. Excellent condition. $60.00
PLUGS—Set for SCR-522.....NEW 3.75
PE-94C-24 Volt DYNAMOTOR...USED 2.50
NEW 4.50
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BC-602 Control Box.....NEW .95
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COPPER 2.95

SOUND POWERED HEAD & CHEST SET, made by Automatic Elec. Co. .....PAIR $11.00
NEW—EA. 5.95

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BC-641C AMPLIFIER only..... 9.95

400 Cycle INVERTER—G.E. 5DZ1NJ3A Input 27 V., 35 amps. Output 115 V.—485 V.A. single phase.....$12.50
400 Cycle INVERTER—G.E. PE-218 Input 27 V., 100 amps. Output 115 V., 1,500 V.A. Single phase.....USED 17.50
NEW 29.50
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BC-348 Outlet Plug..... .69
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MINE DETECTOR-SCR-625A Used for locating metal, underground pipes, gold, etc.
NEW WITH MANUALS.....$69.50
USED EXCELLENT COND..... 45.00

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PE-237 Heavy duty vibrator power supply, 6, 12, or 24 V., input, 525 V., 95 ma.; 105 V., 42 ma.; 6.3 V., 2 amps; 6 V., 500 ma.; 1.3 V., 450 ma.; small supply 100 V., 17 ma.; 1.35-450 ma. with tubes, shock mounted .....BRAND NEW $27.50

SURPLUS RADIO CONVERSION MANUAL, Vol. 1, 115 pages of circuits & data.....Postpaid $2.50
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SPEAKER—6" P.M. compartment, 25 watts, 50-6,000 ohms, waterproof, Excellent Used..... 8.95
TERMS: Prices f.o.b. Pasadena, 25% on all C.O.D. orders. Californians add 3% sales tax.

3 GREAT NEW TITONES

meet changing pickup needs!

NOW a full line of Titone's amazing ceramic pick ups—made by famous Sonotone! All with these great basic features: Full frequency (response from 50 to 10,000 cycles.) Bell-like supertone makes new or old players thrilling. Climate-proof, moisture-proof, fungus-proof! Lightest pressure saves needle wear, revives worn records. NO needle talk! NO crystals, magnets, filaments to fail. NO pre-amplifiers. Performs perfectly for years!

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For all 45 and 33⅓ rpm players. Highest compliance and 5 to 6 grams needle pressure give minimum wear on record and needle! Aluminum case—1-mil permanent sapphire needle.

Order #W 7530 ..... $7.95 list

2 NEWER! TITONE 3-MIL PICKUP

New superlight aluminum pickup complements famous original Titone pickup below. 15 grams needle pressure gives unparalleled reproduction, lowest wear!

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1 NEW! ORIGINAL CERAMIC TITONE

Within a few scant months in widest use from coast to coast! Plays at 20 grams needle pressure. Used instead of the newer aluminum Titone above for changers requiring over 15 grams pressure to "flip" records.

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Call your Jobber or write to
SONOTONE, Box 5, Elmsford, N. Y.

Spot Radio News

(*Continued from page* 18)

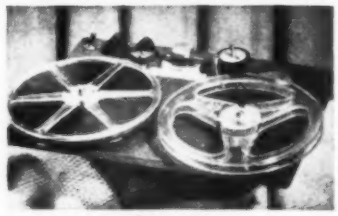
stituted of 3.8 mc. dots. A thirtieth of a second later, because of dot interlace used in the system, another series of 3.8 mc. dots would be superimposed on this same line, but shifted halfway between the original dots. Thus the line structure would consist of an average component and 7.6 mc. and higher order components. Therefore, viewed Goldsmith, while a 7.6 mc. sine wave pattern might not prove bothersome, even though resolved at close viewing, there are many receivers which normally produce a noticeable 4.5 mc. sound beat in the picture. And when such receivers pick up color signals, there would be a beat note between the 7.6 and the 4.5 mc. signal in the picture.

In an analysis of receiver costs, Goldsmith said that the added circuits of the *RCA* system, which include video amplifiers, deflection circuits, anode voltage supply, and power supplies for three projection tubes and the required sampling pulses and commutator circuits, would cost as much as a medium-priced black and white set. We were also told that there is serious doubt about the practicability of any optical system which must accurately register three images. These images would be extremely difficult to set at the time of installation and to keep in alignment during the life of the receiver, Goldsmith stated.

Engstrom cited that he was aware of the limitations of the system being demonstrated in Washington, particularly the converters, but that in from six to twelve months, the basic problem of picture tubes would be solved with a single three-color tube.

IN AN EXTREMELY informative brief, David B. Smith of *Philco* reviewed why compatibility was so important to color and why systems affording such service must eventually be adopted. He pointed out that with the development of the dot-interlace technique, it has become possible to use the present 6 mc. band with adequate definition and freedom from flicker. Describing how this is possible, he said that the idea of dot interlace was to take each line of the picture and divide it up into a series of equally spaced dots and blanks. Thus all the information or detail heretofore spread over the whole line was now spread over only the dots, and not the spaces. And the next time that particular line was scanned, the position of the dots and spaces was reversed, the two sets forming a complete line. The interesting part of this procedure is that though the amount of picture detail of the line has been doubled, the time of transmission has been halved. In other words, declared Smith, a complete picture now requires four interlaced fields, rather than two and hence takes a fifteenth of a second rather than a thirtieth. Yet the picture con-

Assemble Your Own Magnetic TAPE RECORDER



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Screwdriver, Pliers, Soldering Iron are the ONLY tools you need

- Enjoy crystal-clear tape recordings of radio music, conversation — any sound, at a fraction of the usual cost. DuoTape aids speakers, improves musical talent, provides party fun.
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QUALITY SPEAKERS at less than manufacturers cost. Not rejects but finest quality speakers used in many well-known makes of radios. COMPARE OUR PRICES!

SIZE	EACH	LOTS OF 10, EA.	SIZE	EACH	LOTS OF 10, EA.
4" PM	$1.17	$1.07	4x6 PM	$1.37	$1.27
5" PM	1.27	1.17	6x9 PM	3.15	2.95
5" 225	.67	.65	MAGNAVOX		
6" 6V	1.77	1.47	6" PM	3.35	2.85
6" PM	1.77	1.47	8" PM	3.75	3.35
8" PM	3.47	3.25	10" PM	4.85	4.65
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You may buy 10 mixed sizes to get lowest prices.

POWER-FULL TRANSFORMER VALUES!

40 ma, 350 vct, 6.3v @ 1a, 5v @ 3a; 2" x 3" x 1½" $1.45
60 ma, 550 vct, 6.3v @ 5a, 5v @ 3a; G-E upright mounting 2½" x 2¾" x 3" fully cased 2.75
85 ma, 330 VDC, 6.3v @ 7.5a, 5v @ 2a, 6.3v @ 2a hermetically sealed case 4" x 3½" x 6" 3.35
85 ma, 315 VDC, 6.3v @ 2.1a, 5v @ 3a. Jefferson hermetically sealed case 4" x 3½" x 6" 2.75
90 ma, 700 vct, 6.3v @ 4a, 5v @ 3a; 3½" x 3" x 3½" 3.45
120 ma, 700 vct, 6.3v @ 1½a, 5v @ 2a, 2.5v @ 2½ amp. Case 3¼" x 3½" x 3¼" 3.65
150 ma, 250 VDC, 6.3v @ 5a, 5v @ 3a. Jefferson hermetically sealed case 5" x 4" x 5" 3.15
200 ma, 800 vct, 6.3v @ 6a, 5v @ 4a; 4" x 4" x 4½ 4.45
200 ma, 740 vct, 6.3v @ 3a, 5v @ 3a; 2.5v @ 5a; upright case 4" x 4½" x 5" 3.95

ALL HAVE 115-volt, 60-cycle primary windings.

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150 Volt			450 Volt		
CAPACITY	EACH	10 for	CAPACITY	EACH	10 for
4 mfd.	$0.27	$2.30	8 mfd.*	$0.49	$4.50
8 mfd.	.30	2.50	10 mfd.*	.53	4.90
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20 mfd.	.35	2.75	16 mfd.*	.67	6.00
30 mfd.	.40	3.25	20 mfd.*	.75	6.75
40 mfd.	.45	3.50	30 mfd.*	.82	7.35
20-20	.45	4.00	40 mfd.*	1.00	9.00
30-30	.49	4.35	8-8 mfd.	.88	7.90
40-40	.49	4.35	15-15*	.90	8.00
50-30	.49	4.35	16-16	1.10	9.50
50-50	.59	4.95	20-20*	1.20	10.00

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tains twice as much detail. Explaining the flicker characteristic, Smith said that the large area flicker is the same as with present standards, and on the other hand small area flicker is at a lower rate. However, he went on, because the dot area is so small, the threshold rate of interdot flicker perception can be arranged to be above that of the large area and therefore the over-all flicker threshold for this type of picture pattern is the same as that of present pictures.

A galaxy of talent, technical and administrative, came forth to support the *CBS* system. The stellar witness, Dr. Peter C. Goldmark, who developed the scanning-type arrangement, declared that their system has been sufficiently field-tested with live, film, and slide pickup and could be introduced at present, while the others systems were of an experimental nature requiring at least six or more months of testing. The fact that a spinning disc was required to provide color was no more of a problem than the three-tube setup prescribed for the other systems, Goldmark emphasized. The largest direct-view receiver that could be built under the *CBS* system would have a 12½-inch tube, which might be magnified to 15-inch proportions with a lens, the *CBS* inventor disclosed.

Many manufacturers also appeared for *CBS* to testify that they could produce receivers and converters under their patents at moderate prices and for delivery within ninety days after "green-light day."

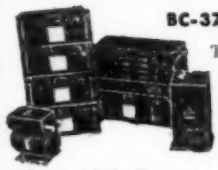
While no conclusive opinion on the results of the color wrangle could be obtained, as this column was being prepared, there was a general consensus that industry agreement on the 6-mc. color possibilities was a boon which might minimize some of the high-band problems.

PAY RAISES for members of the FCC appeared to be well on their way, when the Congressional committees in a late fall meeting approved an executive pay bill. Passage of the bill will provide a $15,000 annual salary for each of the seven members, an increase of $5,000.

This grant will, it is certain, eliminate the fear of Commission resignations which had been rampant, particularly in the cases of Chairman Wayne Coy and Commissioner Frieda Hennock. Coy had been slated for a variety of top jobs, including presidency of TBA, while Miss Hennock was toying with a Jr. Cabinet or Ambassador's post.

ENGLAND'S first big radio show since the end of the war, *Radiolympia*, held at Olympia, London, in the early fall, attracted practically every radio and TV manufacturer in the Isles and on the Continent. TV receivers were highlights of the show, with 9 and 12-inch direct view and 16 by 22-inch projection types featured by the bulk of manufacturers. Three sides of the grand hall gallery at the exhibition hall were set aside for TV demonstra-

TERRIFIC RADIO BARGAINS!

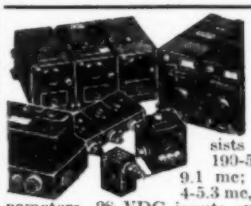


BC-375 TRANSMITTER

Thousands of usable parts. Complete with all tubes, 7 tuning units. Covers 200kc to 12 mc (less BC band). Equipped with antenna tuning unit BC-306-A — variometer and tap switch. Dynamotor complete with relay, fuses, and filter. Plugs inc. Weight, approx. 175 lbs. Slightly used. Bargain! **$57.50**

SCR-522 VHF XMTR-RCVR

10-tube, xtal controlled revr, 7-tube xmtr. Makes ideal 2-meter, 2-way mobile rig. 100-156 mc. With Dynamotor, control box, all plugs and tubes. Excellent cond. .. **$59.50**
Antenna for SCR-522 .. **$2.95**



SCR-274-N COMMAND SET

Easily converted to 10 meter mobile, 20, 40, 80 meter bands. Consists of 3 receivers—190-550 kc, 3-6 and 6-9.1 mc; two transmitters, 4-5.3 mc, 5.3-7 mc; four dynamotors, 28 VDC input; one modulator; and tuning control boxes, antenna coupling box, antenna relay, vacuum condenser, and complete set of tubes for each unit. Complete set of plugs for all units.
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Covers 520 Ke to 1500 Ke Broadcast Band. 6 Tubes: 3—12SK7, 1—12SR7, 1—12A6, 1—12K8. Designed for dynamotor operation; can be easily converted to 110 volt or 32 volt use. Two IF Stages. Three-gang tuning con. BRAND NEW, in sealed carton, with tubes and instruction manual, less dynamotor **$24.95**

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BC-456—MOD	Used	2.95	New	3.95
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BC-458—XMTR	Used	6.95	New	9.95
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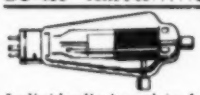

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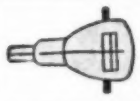
RK60	.65	225	3.95	26	.49
211	.88	837	1.75	27	.44
8020	3.25	714A	4.95		



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Famed Collins Xmtr Antenna Switch. 9200 peak volts. 8 amperes. BRAND NEW! Only **$3.49**

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24-VOLT STORAGE BATTERY— Brand New 17 Amp. Hrs.

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WILLARD 2-VOLT STORAGE BATTERY
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20 Ampere-Hours

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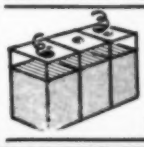
Navy Standard, Black Rubber Case. BRAND NEW. 15 Amp Hour Rating. **$5.95**



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800 VCT/500 VCT/250 ma., 6.3 V/5A, 6.3V/5A 6.3V/2A, 5V/3A, 5V/3A shell type 5.95

Pri. 115V 60 cycles. Sec. 1000V C.T., 250 ma. 6.3V C.T., 6A; 5.0V C.T., 4A; 6.3V C.T., 4A. Sealed case 5.95

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Pri.—110—230V/50—60 cycles 1050 VCT/75 ma., 740 VCT/175 ma., Hermetically cased $2.95

300V/150V, 300V/150V, .014KVA, GE cased ..... .95

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5VCT/3A, 2½ VCT/5A. Hermetically cased $1.25

Pri.—105-115-125V/50-60 cycles. Sec.—2½ VCT/20A open mounting type 2.95

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Pri.—115 volts, 60 cycles. Sec.—200 volts, 10 ma.; 825 volts, 110 ma.; 6.3 volts, 3.5A.; 2.5 volts, 1.75A.; 2.5 volts, 1.75A.; 5.0 volts, 3A.; 6.3 volts, 6A.; 6.3 volts, 6A.

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Receiver—5-tube—Highly Sensitive

Two Bands—Broadcast (600-1500 KC) and 200-400 KC.

Has built-in 1000-cycle Range Filter with On-Off Switch, Volume Control, Bandswitch and Transmitter On-Off Switch.

These units are sold as-is, some requiring minor repairs—less connecting cable. Price, per Pair **$13.75**

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Types WW3, WW4, WW5

Following sizes are $0.35 each: $27.50/100:

800,000 1%	600,000 1%	125,000 1%
700,000 1%	220,000 2%	120,000 1%

Following sizes are $0.25 each; $19.50/100 most sizes are 1% or better—others 2%:

95,000	20,000	7,500	1,400	70
92,000	17,000	5,000	1,200	50
84,000	15,000	4,500	1,000	30
82,000	12,000	4,300	750	22
80,000	11,000	4,000	140	20
66,000	10,000	2,200	130	14
46,000	8,000	1,500	125	12
33,000				

Following sizes are $0.15 each; $12.50/100 odd types are 1% or better, round numbers are 3% or better:

.399 meg.	26,500	2,230	235	40
.268 meg.	22,000	1,123	110	35
109,000	20,820	988	70	30
54,500	17,300	280	50	6
50,000				

Following sizes are $0.10 each; $8.50/100 most sizes are 1% or better:

414.3	53.96	13.333	3.94	1.563
366.6	53.32	10.2	3.5	.29
220.4	33.22	5.1	2.56	.256
147.5	23.29	4.3	2.14	.25
105.8	13.52			

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tions. A special TV studio served as the center of many BBC programs. Activities in the studio could be seen from vantage points in an area known as the *Television Studio Parade*.

WASHINGTON WAS shocked to learn of the suicide of Ray C. Wakefield, who served as FCC Commissioner from '41 to '47.

One of the Commission's most popular members, he was appointed to his seat by the late President Roosevelt to succeed Thad H. Brown. Prior to his tenure with the FCC, Mr. Wakefield had been vice-president and chairman of the executive committee of the National Association of Railroad and Utilities Commissioners. In his post at the FCC, he presided at many important hearings and issued decisions which have been applied widely in contested sessions.

In a tribute to his public service, the FCC group said . . . "We feel his loss deeply. His valuable service on this Commission was but one phase of a life unselfishly devoted to the public service." . . . . . L.W.

ADDITIONAL NOTES ON AMPLIFIER FOR SOUND ON FILM CONVERSION

By RAOUL ZAMBRANO

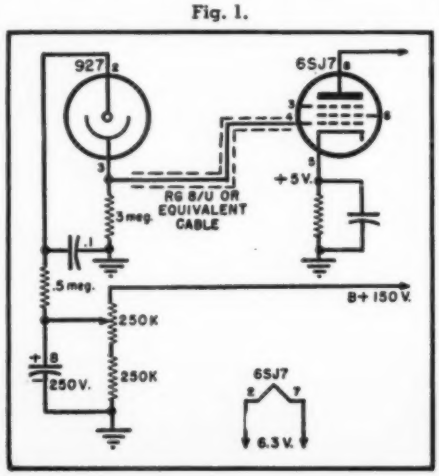
I have read with interest both R. L. Newland's and R. L. Muhs' articles on "Sound on Film Conversion" appearing on page 104, March and page 88, June issues of your publication.

In setting up the system identical to the one shown by Muhs, I have run into considerable difficulty regarding microphonics. In experimenting around, I developed a circuit that in my estimation is a considerable improvement to the one shown.

In the circuit (Fig. 1) I have been able to eliminate the blocking condenser in the cable and at the same time remove the B+ potential from the cable. In doing so the cable assembly is simplified and at the same time I have eliminated microphonic effects. With the B+ potential impressed on the cable in accordance with R. L. Muhs' circuit, the microphonic effect of the cable, particularly when it was tied to the projector mechanism, caused more microphonic effects than that of the tube.

—30—

Fig. 1.



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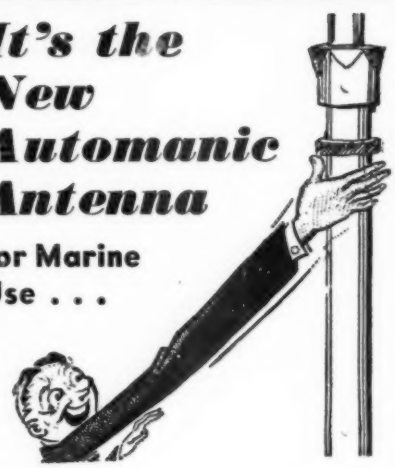

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- **Push pull phase inverter driver for low hum and distortion**
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- **Separate bass and treble control**
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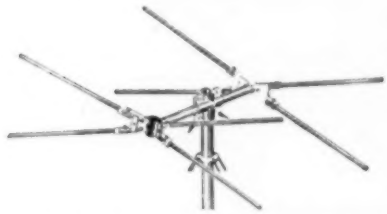

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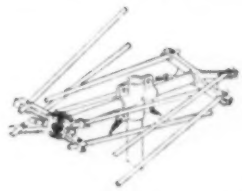

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1H5	3S4	6BA7	6J7GT	6SQ7	12BA6	12SQ7	38	70L7
1L4	3V4	6BE6	6K5GT	6SU7	12BA7	19T8	41	75
1N5	5U4	6BF6	6K6GT	6T8	12BE6	25L6	42	76
1P5	5Y3	6BG6	6K7GT	6V6	12F5	25Z6	43	77
1Q5	6A7	6BH6	6P5	6W4	12J7	26	45	78
1R5	6A8GT	6BJ6	6Q7	6X4	12K7	27	45Z5	80
1S5	6AC5	6C4	6S8	6X5	12S8	32L7	46	82
1T4	6AG5	6C6	6SA7	12A8	12SA7GT	35	47	84
1T5	6AK5	6D6	6SD7	12AL5	12SF5	35B5	50B5	85
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Printed Circuits

(*Continued from page 48*)

melting point by a hydrogen-acetylene or other flame. Compressed air is used to atomize the molten metal and to drive it on to the work. This molten material can be sprayed on wood, bakelite, plastic, and even ceramic surfaces.

One popular method employs a plastic base plate. This plate is sandblasted through a mask so that shallow grooves are cut where the conductors are needed. These grooves are sprayed full of molten metal, after which the surface can be milled, leaving conducting lines that are flush with the surface of the plastic base plate.

Still another scheme uses an insulated base plate with a thin evaporated coating of conducting metal. This is covered with a photosensitive film and exposed to light through a mask. The film is developed so that the portions exposed to light are removed, and the remaining portions, outlining the desired circuit, resist an abrasive spray so that the protected portions beneath remain intact while the rest of the metallic coating is cut away by the sand blast.

Another method of producing "printed circuits" is by chemical deposition. This method is not used much on a commercial basis because of the very thin layers deposited and other technical difficulties, but it consists essentially of depositing a thin silver coating on a masked surface by the same chemical methods that are used in silvering mirrors. Increased conductivity can be secured by repeated silvering or by plating.

Cathode sputtering and *evaporation* are two other processes for depositing the metallic film. In the former, the material to be deposited is used as a cathode and the masked base plate is used as the plate of a temporary vacuum tube. The "plate" is maintained at a high positive potential with respect to the cathode, and the latter is raised to a volatizing temperature. The metal particles emitted by the cathode are attracted to and deposited on the base plate through the stencil openings.

The evaporation process is the same except that the plate is not maintained at a high positive potential. The cathode material is simply heated in the vacuum until it vaporizes on to the work. This permits the use of nonmetallic as well as metallic base plates. In neither case is the film deposited thick enough to be used for conductors, but this can be overcome by plating.

The radio technician is very familiar with one form of printed circuit: the die-stamped loop antenna. This is produced by placing a thin sheet of copper on top of a composition or bakelite panel with a layer of thermoplastic cement between. This sandwich is placed in a punch press, and at one stroke the metal is cut into a helix and is bonded to the panel.

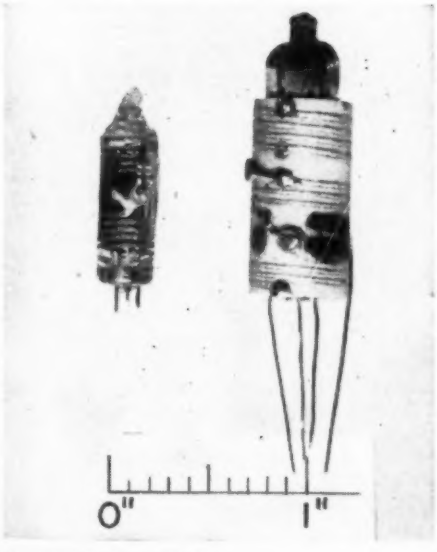
Dusting is the final major method of printing circuits. This consists of depositing a layer of metallic dust on a base plate along the lines where conductors or resistors are required and then raising the temperature sufficiently to drive off the bonding material and to fuse the metal particles together and to the plate. The entire plate can be covered with an adhesive material and the dust applied through a stencil, or the adhesive material can be applied through the stencil and then the whole plate subjected to dusting, with the same results.

While an attempt has been made to touch on all of the methods ordinarily used for printing circuits, the new industry is advancing so rapidly that one cannot be sure how long this will hold true Very recently, for example, the *Glass Products Company* of Chicago announced a new process, *"Microscreening,"* which they claim has several advantages over the silk-screen methods. Unfortunately, because of current patent proceedings, details of this new method are not available.

Several illustrations are given to show the wide variety of devices to which printed circuits are applied. For a more detailed discussion of the various methods discussed in this article, the author recommends the purchase, for 25c, of "Printed Circuit Techniques," by Cledo Brunetti and Roger W. Curtis. This *National Bureau of Standards* Circular 468 can be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. An excellent group of references for further reading will be found in the back of this booklet.

Part 2 of this article will be concerned solely with explaining and illustrating how the experimenter can design and construct his own printed circuits with materials easily obtainable. *(To be continued)*

Fig. 9. Two complete high-frequency transmitters ready to be connected to a power supply. The one printed on the glass envelope of the 6J4 tube operates on 136 mc.; that printed on the ceramic cylinder surrounding the subminiature triode operates on a frequency of 116 mc. Both transmitters are intended for grid modulation.



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6AT6	6BA7	12SN7
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LETTERS from our readers

THE C.W. RECORD

"WE HAVE noticed a number of letters in your column recently to the effect that code (c.w.) transmissions are inefficient, and have now become hopelessly outmoded. For the record here are a few facts that may be of interest.

1949 ARRL Sweepstakes Contest—Highest c.w. score, 183,690 points: highest fone score, 85,896 points: number of c.w. scores over 100,000, 82; number of fones over 60,000, 8.

1949 April CD QSO party—Highest c.w. score, 659,498: all leaders operating c. w.

"1948 World Wide DX Contest—Highest c.w. score, 452,454 (GI6TK, 150 watts): highest fones, 124,069.

"1949 ARRL DX Contest (unofficial, claimed totals)—Highest c.w. score, 390,450: highest fone, 223,040: 12 c.w. scores over 250,000.

"There are many examples of this type but we will not take space at this time to enumerate them, however it is worthy of note that the leading traffic (message) handling stations are c.w. and in disaster zones where normal power is lost c.w. stations invariably initiate emergency communications. Code is still used in the Army, Navy, by international news services, Merchant Marine, ship-to-shore, etc.

"The person who feels that c.w. is slow and cumbersome should have the privilege of monitoring both sides of a brisk c.w. contact with both operators using full break-in. The amount of intelligence that can be exchanged with this system is tremendous, and under adverse conditions cannot be matched by any other mode.

"Thank you for your interest in the amateur and best wishes for your continued success."

E. O. Hamilton, WØLZY
Colorado Springs, Colo.

* * *

NEW HAM REGULATIONS

"THE NEW regulations, as proposed, are merely something which has been long overdue. There is nothing in them which would deter any person with will power and determination. If it is felt that many would be deterred from becoming amateur radio operators simply because the new rules won't permit them to run a kw. fone on 80 meters without first proving their ability—then I say we are well rid of such deadwood. . . .

"As they stand, the new rules do not prevent anyone from getting a license—they merely raise the standards. Anyone, with a little time, can meet these standards. I know, for I have been teaching the stuff to 15-year-old kids. Anyone who says he simply cannot get code over 8 or 10 w.p.m. or any number of this degree, simply has not tried. . . .

"Technical skills have advanced immensely in the past 20 years—why haven't the requirements kept pace? If amateurs are to become button-pushers with their "boughten" receivers, transmitters, and antennas installed by the dealers, then where does any skill or training come in? If that is to be the case, then by all means let's have easier licensing. Let's have the only requirement a birth certificate. Let's have the only limitation be the fatness of the wallet of the applicant.

"The QRM problem would not be half bad if the problem were attacked intelligently. Single sideband is fine—so is 10 kw.—but the best solution would be to open, say, the 75 meter fone band to, say, 500 amateurs. Then hold an open competition among all those interested. The best and most able would have the privilege of operating 75 fone. The same way with other choice bands. In that way anyone who wishes to put his p.p. 304's on 20 meter fone would have to prove his ability—not merely show his wealth. . . ."

W. C. Johnson, W1FGO
Norwich, Vt.

* * *

SEE PAGE 54, DONALD

"IN THE July issue, Sayre Rodman came out and said what we have all been thinking for a long time.

"Many people go in for the technical aspects of radio, as Mr. Rodman does. I am one of these people. Recently I secured a commercial second class telephone ticket, and now I am well on my way toward a first class license. I am only a teen-ager (just turned 17) and I know many of my schoolmates who hold similar tickets would like to become hams, but cannot master 13 w.p.m.

"Despite hours of practice I have been unable to get past 8-10 w.p.m. If the code speed were lowered look at the new blood hamdom would receive. 'Experience is the best teacher,' therefore I am sure that if we teen-agers were given a chance to get on the air our code speed would raise itself to 15-20 w.p.m. in a short time.

"The new proposed 'technicians' class of license is a big step in the right direction. It will have to be backed by everyone interested if it is to become a reality."

Donald Chadwick
Staten Island, New York

* * *

LORAN'S OK

"OBVIOUSLY readers like Mr. Baughn (Letters, July, 1949) have not spent a great deal of time

sitting out there over the ocean for hours at a stretch without benefit of celestial fixes. With the sky obscured and the aircraft far out of d/f range, Loran has proved its worth many, many times.

"Born of the exigencies of war, Loran has demonstrated its excellent capabilities as a peacetime aid to long-range navigation. Until the experts get squared away with the l.f. Loran, sharing the 160 meter band with this fine navigational facility should not inconvenience anyone to any great extent."

Harold G. Lambert
Alexandria, Va.

* * *

FAIR TRADE

"I READ Mr. Christensen's article on Fair Trade (October, 1949) and maybe some of those dealers are justified in what he calls "cut-throat" prices. The reason I make this statement is from my own experience.

"For instance, in the case of a 35Z5GT which lists at $1.25, I had to pay $1.50 for it. The dealer had to pay about $.61 for the tube so he made an additional $.25 on the tube over and above his normal profit of 105%. How much do they expect to make on one item?

"I don't have any figures on TV sets, but if the percentage is as high on them as it is on parts, I don't see where dealers have any squawk coming. I think it is about time some of them wake up.

"I enjoyed 'Mac's Radio Service Shop' article. I think more dealers should conduct their businesses along the general lines set forth by Mr. Frye in these articles."

Paul W. Cline
Kenton, Ohio

* * *

SIGNAL TRACERS

"LAUDATION and high praises to you and John Burke for his letter which was printed in the September issue.

"John has the right idea. A signal tracer is a wonderful gadget, don't get me wrong, but it definitely isn't the answer to all the troubles that some of your (and other) writers would have you believe.

"I will freely admit that its use on one or two out of ten sets is a great help, but in my shop those one or two sets are usually r.f. intermits. My rule of thumb for the preliminary checks on all sets (which usually finds the trouble) is a finger for audio and a bit of metal on an r.f. grid for the front end, coupled with a good v.t.v.m. and some headwork.

"Don't get me wrong again. I own and use, where needed, a fair amount of good equipment, but I cannot see using it where it is simpler and faster to use my head and hands."

George E. Hindley
Allentown, Pa.

* * *

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VAPN-4 5" Scope Indicator. NEW $29.95
VBC-929 3" Scope Indicator. NEW $19.95
VBC-709 Interphone Amplifier—operates on 2 flashlight cells and one 67½ volt B battery—ideal for two-way interphone system, booster telephone—has terrific wallop for a small package. Less batteries. NEW $4.00
VBC-733 D Receiver less dynamotor. NEW $10.95
V BC-357 Receiver. NEW $3.40

SENSATIONAL!! NAVY TRANSMITTER RECEIVERS
MO-1 Transceiver Freq. 3-8 MCS A2, A3 Emission. 25 watts with 6 volt power supply $49.95
RDF Receiver Fixed Tuned 200-850 KC. Brand New. Includes:
- 4 Sets of Plug-in Coils
- 5" Speaker—Mounted on Panel
- Connecting Cables
- Operates on 110 VAC 60 Cy
- Spares $39.95

ROUND PANEL METERS

10-0-+6 DB	Weston	2½"	$4.50
0-4 RF Amps	GE	2"	4.00
0-5 RF Amps	Weston	3½"	4.50
0-15 RF Amps	GE	2½"	3.75
0-300 MA DC	Simpson	2½"	3.75
5-0-5 MA DC	Weston	3½" with 50 MA Shunt	4.25
0-8 Amps DC	McClin.	2½"	1.95
0-50 Amps DC	Weston	3½"	4.75
0-100 Amps DC	Heyt	3"	5.00
0-3 Volts DC	Gruen	2½"	1.95
0-15 Volts AC	GE	3½"	4.95
0-5 Kilovolts DC—0—10 MA DC		3½"	5.75

PORTABLE METERS

0-10 Amps DC	Weston	489	7.50
0-25 Amps AC	Weston	433	23.95
0-3-6-30 Volts DC	Weston	780	17.50
0-300 Volts AC	Weston	433	24.95

ALL PRICES SLASHED!!!
CAPACITORS
Bath Tub

		EA.	TEN
40 mfd	25 VDC	$0.28	$0.23
4 mfd	50 VDC	.33	.28
50 mfd	50 VDC	.38	.33
.5 mfd	120 VDC	.14	.09
2X.1 mfd	200 VDC	.18	.13
3X.1 mfd	400 VDC	.23	.18
.05 mfd	600 VDC	.18	.13
2X.05 mfd	600 VDC	.23	.18
.25 mfd	600 VDC	.23	.18
.5 mfd	600 VDC	.23	.18
.1 mfd	600 VDC	.23	.18
1 mfd	600 VDC	.33	.28
2 mfd	600 VDC	.43	.38

Oil-Filled and GE Pyranol

.5-.5 mfd	400 VDC	$0.33	$0.28
1 mfd	500 VDC	.28	.23
2 mfd	600 VDC	.33	.28
4 mfd	600 VDC	.53	.48
5 mfd	600 VDC	.58	.53
6 mfd	600 VDC	.68	.68
8 mfd	600 VDC	.98	.89
1-8 mfd	600 VDC	1.18	1.08
10 mfd	600 VDC	1.08	.98

Electrolytics

2500 mfd	3 VDC	$0.15	$0.10
500 mfd	12 VDC	.80	.75
25 mfd	25 VDC	.20	.15
1000 mfd	25 VDC	.85	.80
150 mfd	50 VDC	.25	.20
2000 mfd	50 VDC	.75	.70
500 mfd	200 VDC	1.00	.90

DE-ION LINE STARTER
DPST 115 VAC 60 Cy 15 Amp 1 Horsepower Rating, Westinghouse size #0. NEW $3.25

TRANSFORMERS
PRIMARY 115 V 60 CY
Secondaries 9 V @ 750 MA; 6.3 V @ 3.9 A; 5 V @ 6 AMP 2400 Volt Test $3.00
Secondaries 6.6 V @ 0.6 A 2000 VINS; 2.6 V @ 1.75 A 2700 V INS. $1.75
Secondaries 6.4 V @ 10 A; 6.3 V @ 0.6 A. $2.75
.275/.363 KVA Secondaries 1000/500—6.3/2.5 ..... $5.50
Auto Transformer 55 VA 60 CY 110/78 V $1.75

TUBE BARGAINS!

2C34	$0.25	2051		$0.40
2C44	.65	7193		.25
2X2A	.55	9002		.35
2X2/879	.35	9003		.35
3C24	.38	9006		.25
3C30	.35	3BP1		2.25
3E29	7.95	5BP4		3.45
7C4/1203A	.35	5CP1		1.75
10Y	.45	5FP7		1.00
10T1	.45	C5B		7.75
15E	1.25	CEQ72		1.30
15R	.75	CK70		3.95
45 SPEC.	.28	CRP72		1.25
54 GAM.	4.50	HY615		.50
211	.45	RK72		.95
316A	.50	RK73		.95
450TH	17.50	VT-127A		2.25
713A	.90	1J6GT		.85
750TL	43.50	3Q4		.55
801A	.45	6AJ5		.75
803	4.25	6AC7W		.75
805	4.25	6C4		.25
807	1.00	6H6		.40
826	4.10	6K6GT		.45
830B	3.45	6L6		1.10
864	.45	6SD7GT		.65
872A	1.45	6SG7		.55
957	.20	6SH7		.45
CK1005	.35	6V6G		.55
E1148	.35	12A6		.20
1626	.35	25L6GT		.55
1629	.78	25Z5		.45

SAVE $$$ Rotary Switches

Pole	Position	Section	Shaft	Price
2	4	6	1"	$0.30
4	10	4	1"	.35
3	8	2	2½"	.30
4	10	2	2½"	.35
4	12	2	4"	.45
2	8	2	30A 90 KVA FLASH OVER	1.45
2	10	3	1½"	.50
2	12			
3	2			
2 POLE 2 CIRCUIT 6 CONT w/KNOB				.33

$ TIME DELAY SWITCHES $
1 Minute 115 VAC 60 Cy Enc. in waterproof metal case..NEW $2.95
3 Micro Switches make contact at 40-41-42 Sec. time delay 110 VAC motor ..... NEW $4.00

Microphones—Headsets
Sound Powered Chest Microphones ..... NEW $4.95
Hand Set Holder ..... NEW 1.00
HS-33 600 ohm Headset..NEW 1.95
T-17 Microphone 1.25
T-30 Throat Mike ..... .40
MC-385 Adapter HI to LO Imp. .39

$$ VALUES—VALUES $$
POWER EQUIPMENT
Inverter PE-151 Input 12 VDC Output 110 VAC 150 W 60 Cy NEW $10.95
Vibrapack VPG-360 12 VDC Output 250 V @ 70 MA Synchronous Mallory ..... NEW $3.48
Voltage Regulator Raytheon 95/130 V 60 Cy 1.25 Amp Output 115 V 60 Watt ..... NEW $9.50
Vibrator ATR 2410 24 VDC Output 110 V 100 W ..... NEW $2.95
ATR Inverter 12 VDC to 110 VAC 50/60 Cy 100 W ..... NEW $16.75
PE-140 Power Supply 29.95

$ RELAYS $
6 VDC DPST Contacts 6 A Coil 33 Ohms $0.45
12 VDC DPST Allied Control Box 232 ..... .85
24 VDC DPDT Allied BJD36 ..... .80
24 VDC 3 PDT 8 Amp GE ..... .85
24 VDC SPST 50 Amp Current Leach ..... .90
24 VDC Solenoid operates 2 Micro Switches 1.25
110 VAC DPST 1 Amp Contacts S-D CXA 1070 ..... 2.45
40 VDC DPST-SPDT 1000 Ohm Coil ..... .65
115 VAC 30 Amp Contacts—Shunt SPST 115 VAC S-D CXA-2097 ..... 3.25
220 VDC DPDT 2 Amp Contacts CX2122 ..... 3.95
230 VAC DPDT Coil 470 Ohms Enclosed GE 12HGA11A2 ..... 4.95
Overload SPST Opens @ 500 MA DC Voltage Drop 10 1KW AC Contacts 1.85

TIME DELAY LINE
400 Cycle Pulse Rate 50 Ohms Internal Resistance 15,000 Peak Voltage ..... NEW $4.95

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Battery Tester 0-10 Volt 0-35 Amp with Pocket Case $0.85
Genuine Up-right Telephone and Ringing Box 3.25

SPECIALS
80.86 KC Crystal in Holder..$1.50
200 KC Crystal in Holder..... 1.35
MN-26Y Remote Control 4.50

WIRE WOUND POTENTIOMETERS

CAT. NO.	OHMS	WATTS	TAPER	BUSHING	SHAFT	MFR	EA.	TEN
.107	20	25	LINEAR	⅜"	1⅞"	DEJUR	.45	.40
.207B2	25	25	LINEAR	⅜"	1⅞"	DEJUR	.45	.40
.048P1	50	25	LINEAR	⅜"	1⅝"	DEJUR	.50	.45
.190B1	100	25	LINEAR	⅜"	1⅛"	DEJUR	.55	.50
N2017	100	25	LINEAR	⅜"	½"	IRC	.55	.45
.147B1	200	25	LINEAR	⅜"	½"	DEJUR	.55	.45
.033	3000	25	LINEAR	⅜"	1⅝"	DEJUR	.65	.55
.155B1	15,000	25	LINEAR	⅜"	1"	DEJUR	.70	.65
.099	20,000	25	LINEAR	⅜"	¾"	DEJUR	.85	.70
.105	20,000	25	LINEAR	⅜"	1"	DEJUR	.85	.70
OHMITE	800	50	LINEAR	⅜"	½"	OHMITE	1.10	.95
.079	400/400	50	LINEAR	⅜"	1⅛"	DEJUR	1.10	.95
.024	10,000	50	LINEAR	⅜"	1½"	DEJUR	1.50	1.25
IRC	15	75	LINEAR	¼"	½"	IRC	1.50	1.25
CHMITE	750	150	LINEAR	¼"	½"	w/DIAL & KNOB	2.45	2.10
HELIPOT	20,000 0.5%	5	LINEAR	¼"	½"	GIBBS	4.50	4.00

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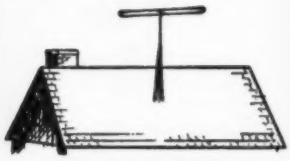
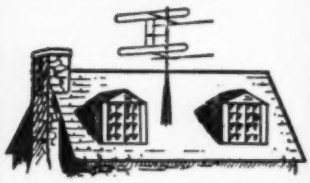


SELL THE BULK! Low price sells lower and middle income groups.



SELL THE CREAM! Improved reception sells upper income brackets.

Right along, tripod-type towers of sectional construction have been the choice of the "cream" of television's market. Through elevating antennae, such towers extend fringe area and improve reception. *Now* — Penn offers a tripod tower priced within reach of the ever-expanding "bulk" market. Be among the first to profit — write today for details about the still-available Penn dealer propositions.

Prices to Retailers

THRIFTOWER "30" — Composed of 20′ of tower welded as a single unit with 10′ 1″ O.D. adjustable pole, total approximately 30′ overall $24.75
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PENN *Teletower*
Penn Boiler & Burner Mfg. Corp.
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ESTABLISHED SINCE 1932
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my share, but the worst so far, as far as time, labor, and expense are concerned, is this one.

"I, like E. J. Dobbie in your July issue, wanted some high fidelity. With this in mind I built an audio amplifier with about 10 watts output. Everything was good except that I had an awfully loud hum.

"In trying to remove the hum I rebuilt the amplifier, relocating all parts and shielding better. No good. I tried changing filter condensers. No good. I added more filtering and some decoupling circuits. Still no good.

"The way in which I found the trouble was a mistake. I had also built a TV set and in the horizontal sweep circuit I used a 6SN7. As the input to my amplifier I had also used a 6SN7.

"One evening my horizontal sweep circuit went bad and for first check I pulled the tube. The closest 6SN7 happened to be in my amplifier so I switched the two tubes and suddenly my amplifier sounded good.

"It seems that a 6SN7 is quite famous for developing hum between filament and cathode. I found this out the hard way and since have changed my amplifier input to a 6SC7 which is less apt to hum." J. H. Stickle
Wharton, N. J.

* * *

A HELPFUL HAM

"I ALWAYS enjoy reading your magazine especially now in the hospital where I have idle time on my hands.

"I read with great pleasure in your August issue about Elhart F. Nelsen's (W9DER) noble offer to assist Charles Apon, a patient in a hospital, secure his ham ticket. I am also a beginner in learning the code and started a few months ago. Lucky enough to have my communications receiver (S-38) with me I was combing the amateur bands daily and tried to copy as much as possible.

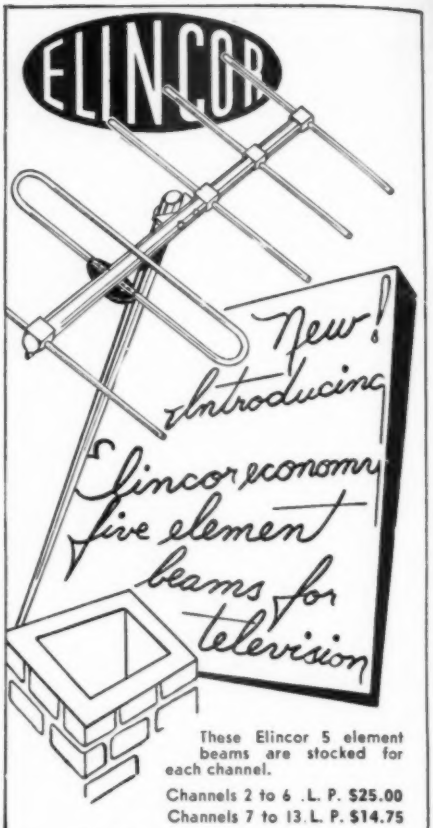
"One day I overheard a QSO between two amateurs about an amateur station, W2VKN, sending code practice. Unfortunately I was not able to copy more about it, but I looked the station up in my call book and asked the operator for information about his sending code practice. To my delight he answered right away in a nice letter and even tried to pay me a visit in the hospital. His name is "Don" of Chatham, New Jersey, W2VKN, running about 200 watts. He is sending code practice every Monday through Friday from 5:15 to 6:15 p.m., on 7200 kc., for all who are interested in learning the code. I am writing these lines in appreciation for his noble, unselfish service and as a help to all those "bug bitten" beginners who are longing for help in their endeavor to master code.

"I would be very much obliged if you would tell this to all your readers interested in taking advantage of this code practice."

Reinhold Moeslinger
Willard Parker Hospital
New York City

-30-

ELINCOR



These Elincor 5 element beams are stocked for each channel.
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Channels 7 to 13 L. P. $14.75

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SURPLUS PRICES SLASHED!
DYNAMOTORS

D-2 Converts to 110 V AC in ten minutes, diagram included, contains integral gear box having four ½" drive shafts turning simultaneously at the following speeds:
4000 RPM—Grinders, buffers, flexible shaft tools, etc.
150 RPM—Wrapping fishing rods, slow speed tools.
25 R.P.M—Dev. tray rocker for photo darkroom.
5 RPM—Turning barbecue spits. Adv. Disp. Beams. A Thousand Other Uses Around the Work Shop. ONLY..... $5.95
Converted to 110 Volts AC.....$7.95

D-1 Converts to 110 V AC in ten minutes, diagram included, has shaft with squirrel cage blower, also gear reducer with 2 shafts and pulleys at the other end. 1001 uses. ONLY..... $4.95

6-V. MOTOR A real beauty, removed from aircraft. Type used for auto fan. Many uses. Ea..... $1.50

RM-29 PORTABLE FIELD TELEPHONE

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HEADSETS HS-23 or 33.....Used, 98c
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BC-733D—A 10-tube superhet receiver for lateral blind landing guidance (CAA type certificate TC-1045). Excellent condition 108-110 MC. Tube complement: 1—12SQ7; 2—12SR7; 1—12A6; 1—12AH7GT; 2—12SG7; 3—717A. Tubes alone worth more than this low price. SCHEMATIC FURNISHED.....Each $3.95

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Modern TV Receivers

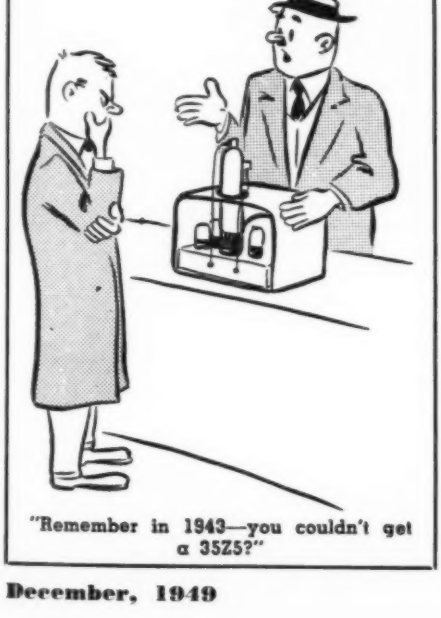
(*Continued from page 52*)

peaks, each of which is used by the three rectifiers. In the flyback supply, only a single positive peak appears across the high-voltage winding. All other peaks, both positive and negative, are suppressed by the damping tube. The reason that one circuit is permitted to oscillate over many cycles, and the other is not, is the presence of the deflection coil in one system and not the other. The circuit of Fig. 6 is designed solely to develop the high voltage; it does not deflect the beam across the screen. In Fig. 2, the deflection coil is part of the high-voltage circuit, and once beam retrace is accomplished, all further oscillations must be suppressed; otherwise, beam motion will be distorted.

The output transformer in Fig. 6 contains another winding which is used for regulation purposes. The voltage developed in this winding is fed to the diode section of the 6SR7 tube where it is rectified and applied as a negative voltage to the grid of the 6BG6. If the output voltage tends to increase, more negative bias is applied to the 6BG6, reducing its interval of conduction and thereby reducing the amount of energy imparted to the transformer. This will tend to lower the amplitude of the oscillations and reduce the high voltage. On the other hand, a reduction in high voltage will cause less negative bias to appear at the grid of the 6BG6, increasing its interval of conduction and resulting in oscillations of greater amplitude in the transformer.

With this self-regulating arrangement, the voltage output is maintained constant within the limits set for this design. An external low-voltage power supply is needed to provide "B +" at 350 volts for the 6SR7 and 6BG6, plus 6.3 volts a.c. for their filaments.

(*To be continued*)



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"Tab"— Specialists in Precision Resistors. We Ship Types in Stock—Accuracy up to 0.1 Percent.

0.1	68	320	670	1712	2200	5270	13000	29000
0.116	74	325	673	1740	2250	5300	13100	29500
0.42	75	330	680	1770	2300	5500	13500	29900
0.425	80	340	697	1800	2400	5600	13550	30000
0.607	81.4	350	699	1818	2450	5730	13600	31000
0.7	84	360	700	1830	2463	5770	14000	31500
1.03	86.8	366.6	711	1865	2485	5910	14250	32000
1.3	90	370	733	1892	2490	6000	14400	33000
1.75	95	375	740	1894	2500	6100	14500	35000
2.3	100	380	750	1895	2525	6125	14550	37000
3	101	387	800	1896	2600	6140	14600	38140
3.83	105	390	806	1897	2625	6200	15000	38500
3.95	105.7	400	850	1898	2635	6300	16000	39000
4	107	410	854	1899	2700	6495	16500	39500
4.35	110	414.3	894	1900	2750	6500	16800	40000
5	121.2	418.8	900	1901	2850	6840	17000	42000
5.025	125	425	910	1902	2860	6990	17500	43000
6.5	130	426.9	917	1903	2870	7000	17977	45000
6.25	135	427	946	1904	2900	7320	18000	47000
7	140	440	978	1905	3000	7500	18300	47500
7.8	147.5	450	1000	1906	3100	7700	18380	48000
7.9	150	452	1030	1907	3163	7717	18500	48660
8	160	460	1056	1908	3259	7900	18800	49000
10.38	165	470	1067	1909	3290	7930	19000	50000
11.25	170	475	1100	1910	3300	7950	19500	52000
12	175	478	1110	1911	3333	8000	20000	55000
13.52	178	487	1150	1912	3384	8094	20441	56000
14.2	182	487	1155	1913	3500	8250	20500	57005
14.25	182.4	500	1162	1914	3509	8500	21000	58333
14.5	200	518	1175	1915	3700	8700	21500	60000
15	200.4	520	1200	1916	3730	8720	22000	61430
16	216	525	1225	1917	3760	9000	22500	62000
17	220	540	1250	1918	4000	9100	22990	64000
19	220.4	550	1260	1919	4030	9445	23000	65000
21	225	575	1300	1920	4200	9500	23150	66600
22	230	580	1322	1922	4220	9710	23325	66650
23	235	588	1350	1924	4280	9800	23400	67500
25	240	600	1355	1926	4300	9900	23500	68000
26	245	612	1400	1950	4314	9902	24000	70000
28	245.	625	1488	1980	4440	10000	24600	72000
30	250	633	1495	2000	4444	10430	25000	73500
31.5	260	640	1500	2045	4500	10500	25200	75000
37	271	641	1510	2080	4720	10600	25333	80000
48	275	645	1518	2095	4750	10900	25400	82000
49	280	649	1600	2141	4850	10936	26000	84000
50	286	650	1640	2142	4885	11000	26500	85000
51.78	289	657	1646	2145	4900	11400	26600	85750
53	299	665	1650	2150	5000	11500	27000	88000
56.7	300	680	1670	2180	5100	11690	27500	90000
60	310	681	1680	2187	5210	12500	28430	93300
63	311.5	684	1710	2195	5235	12600	28500	95000

Any Size Above, Each.....25c. Ten for.....$1.98

100000	155000	200000	250000	330000	470000	654000
110000	160000	201000	265000	333500	478000	660000
115000	165000	205000	268000	350000	500000	680000
116667	166700	210000	270000	353500	520000	700000
120000	167000	215000	275000	375000	521000	716300
125000	175000	220000	294000	380000	525000	750000
130000	180000	225000	300000	400000	543500	761300
135000	180600	229000	307500	402000	550000	800000
140000	185000	230000	311000	420000	570000	813000
141000	186600	235500	314000	422000	575000	850000
145000	188000	238000	316000	425000	600000	900000
147000	190000	240000	325000	450000	620000	930000
150000	198000	245000	330000	458000	650000	950000

Any Size Above, Each.....35c. Ten for.....$2.98

Megs								
	1.39	1.75	2.7	3.673	4.7	6.7	8.5	13
1	1.4	1.8	2.75	3.75	5	7	9.03	13.85
1.1	1.5	2	2.8	3.9	5.5	7.5	9.5	15
1.2	1.57	2.11	2.853	4	6	7.62	10	20
1.25	1.579	2.2	3	4.23	6.3	7.74	11.55	
1.3	1.6	2.25	3.3	4.25	6.5	8	12	
1.35	1.65	2.5	3.5	4.5	6.6	8.02	12.83	

Any Size Above, Each.....70c. Ten for.....$5.98

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MVP 5Meg 10W 10KVwkg	1.49; 8 for	10.00
MVP 7Meg 10W 10KVwkg	1.49; 8 for	10.00
MVP 10Meg 10W 10KVwkg	1.49; 8 for	10.00
12Meg 10W 10KVwkg	1.49; 8 for	10.00
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MVE 50Meg 25W 40KVwkg	1.98; 6 for	10.00

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BA38	103½ V.....$1.49	BA70	90/60/4½ V.....$2.50
BA39	150/75/½ V.....1.29	BURGESS 3VF2BP	.....8 for $1
BA40	90/11½.....89c	Batts Tested Prior Shpg	

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H. Johnson 122-234, w/tube Lock, 5D21, etc.69c
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J. 5-prong STEATITE Johnson, 807, 27c.....5/$1
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P. OCTAL 8-pin & plate Steatite Cinch, 9c; 12/$1
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R. LOKTAL 8-pin & lock Mica 'B HF, 6c; 20/$1
S. KLYSTRON socket Cinch, 35c.....10/$3
T. LOKTAL Amph 49S8L Steatite, 24c.....5/$1
U. OCTAL Amph 78S8 mica Bklte, 8c...25/$1.49
U. 11-pin 78S11/931 Amph, 15c.....7/$1
V. OCTAL Amph 49S8S steatite, 15c...12/$1.89
W. HiV Safety 4-pin Amph 77A4, 30c...4/$1.15
Y. MAGNAL 49S811L ceramic.....93c
BANTAM Jr. 7S-5H Amphenol.....7c
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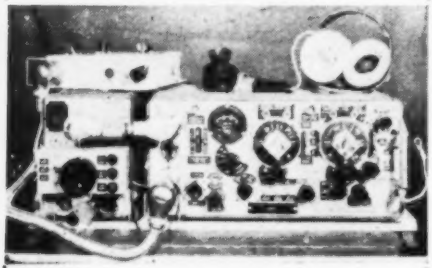

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NEW.....**$64.50—USED**.....**$54.50**
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SPECIAL No. 19 heavy equipment for installation of MK II or III Transreceivers for stationary work. Available in limited quantity. Include Telescopic 34 or 20-foot masts, for aerial installation, complete with ropes, poles, base, antenna wire, etc. . . . Tool bag, complete remote control unit allowing operation of No. 19 from distance up to 2 miles. The latter can also be used as portable telephone or telegraph equipment. Available only for our Customers in No. 19. Price on request.

GENERATORS: Gasoline driven. Complete battery charging equipment. Charging control switchboard with meter, switches, etc. Light weight, portable. 25 Amperes, 12 volts, (300 watts) generator. Not surplus, but present make. Each unit is delivered with its individual guarantee. Specially built for completing No. 19 MK II or III Radio stations. Available for export only. Export packed. Price per unit: $105.00. Inquire if interested in quantity.

ALSO available, but separately: Battery charging control panel. Heavy bakelite specially made for No. 19 MK II or III independent ground installations. Made for fixation on wall. Including all switches and wire connections, etc.

TW-12-L TRANSMITTER for ship to shore work. Manufactured by Marconi. For operation on 220 Volts DC. Including Electric Specialty Dynamotor for plate current: input 220 v. DC, output 1500 v. DC.—Filament current from battery (not included) 12 volts.—Bands covered 375 to 500 Kcs (600 to 800 meters) and 1200 to 3000 Kcs (100 to 250 meters), in telegraphy and telephony. Also covers band 4.00 to 8.57 Mcs (35 to 75 meters).—Using standard British tubes 2/NT40 and 1/NT39.—Complete with Dynamotor, plate current filter, key, Telephone Microphone combination, crystal holder (Crystals not included, but can be supplied for chosen frequency), connecting cables, tubes, aerial, etc. . . . Also one set spare tubes, resistors, fuses. More spare tubes and parts available. This equipment is new, and complete. Especially tough transmitter, which was made in such way as to stand nearby gun fire. Limited quantity available. Packed for export, with Instruction book.....$205.00
Crystals for above.....$16.50
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MN 26 C RADIO COMPASS spares available in quantity, tubes, resistors, condensers, any component. Ask for price list or bulk Maintenance price. Strictly all new equipment.

TERMS—25% on COD orders. Prices are net. Shipments will be made from warehouse, Plattsburg, N. Y. or Montreal, Canada.

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Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

REPAIR CAMPAIGN MATERIAL

The Tube Department of *Radio Corporation of America* has prepared a "Radio-Repair and Tune-Up" merchandising campaign for use by radio service dealers aimed at restoring to good working condition the estimated 10 million radio receivers now needing repairs.

The purpose of the campaign is to stimulate new business for the radio service dealer by overcoming the average consumer's impression that radio repairs may be too expensive. In addition, the campaign provides the dealer with the ready-made means of merchandising and pricing his services effectively and professionally.

Covering all requirements for a comprehensive local promotion, the new campaign ranges from direct-mail to window display material. Included are a colorful five-piece display kit, a three-piece direct-mail campaign, a window streamer, newspaper ad mats, and several spot radio announcements.

The materials for the "Radio-Repair and Tune-Up" campaign are now available from distributors of *RCA, RCA Victor,* and *Cunningham* tubes.

SALES PROMOTION AIDS

Alliance Manufacturing Co., manufacturers of the *Alliance* "Tenna-Rotor," has a handy sales promotion packet available to television dealers and service technicians handling video antenna installations.

The dealer packet, in addition to telling the story of the company's product and outlining the advertising support being offered dealers, contains four merchandising aids for dealer use. These aids include a window streamer in color, a letter of endorsement from a dealer (blown up to 18"x12½"), a reproduction of the two-color, full-page ad appearing in the September issue of RADIO & TELEVISION NEWS, and a full page of newspaper mat reproductions which are available to dealers.

For full details on these sales promotion aids and one of the "kits" write to *Alliance Manufacturing Co.* at Alliance, Ohio.

SALES TRAINING AID

Noblitt-Sparks Industries, Inc. has issued a breezy and informative 16-page booklet which is designed as a sales training help for retail personnel of *Arvin* television dealers.

Written in simple, non-technical language, the booklet suggests to the floor salesman how to present *Arvin* television most effectively and gives him helpful pointers on the "do's and don'ts" of effective television merchandising.

One section of the booklet gives the salesman a "refresher" course in TV tuning with special emphasis on correcting the results of improper tuning and adjusting for interference.

Copies of this handy pocket-size booklet are available from *Noblitt-Sparks Industries, Inc.,* Columbus, Indiana.

LAFAYETTE CATALOGUE

A new radio and television catalogue which lists thousands of items in the electronic field has just been issued by *Lafayette Radio* of New York.

This new publication covers FM and AM radio receivers, television sets, p.a. systems, as well as component parts, replacements, ham equipment, and tools. Enlarged sections have been devoted to high fidelity and television. Featured are "high fidelity" packages of component parts which can be installed in cabinets shown in the catalogue or in cabinets or other furniture the customer may choose.

A copy of the catalogue may be obtained by writing to *Lafayette Radio,* 100 Sixth Avenue, New York 13, New York.

G.E. PARTS CATALOGUE

The Receiver Division of *General Electric Company* has announced the availability of a new catalogue and price list covering all receiver replacement parts for *G.E.* radio and television receivers.

Available from all *G.E.* distributors, this new 52-page catalogue is the first all-inclusive receiver parts list ever made available by the company. It lists all replacement parts for every receiver manufactured by the company prior to August 1, 1949.

N.A.E.D. VIDEO MANUAL

The problems which the television dealer encounters in the installation and servicing of video receivers have been carefully analyzed and presented in a comprehensive 16-page "Manual of Experience" published by the National Association of Electrical Distributors.

According to the introduction, the manual is "intended to act as a guide to prospective television receiver dealers or as an instrument through which existing dealers can improve their present mode of operation."

Among the subjects covered in the manual are selling the set—facts and pitfalls, dealer responsibility, factors

affecting the service setup, direct dealer service, service company liability, service problems, installation problems, multi-channel problems, and qualifications for technicians.

Dealers and others in the industry may obtain a copy of this manual for 25 cents from the National Association of Electrical Distributors, 500 Fifth Avenue, New York 18, New York. Payment must accompany the order.

DEMONSTRATION KIT

In order to spur sales of their 45 r.p.m. music reproduction system, *Radio Corporation of America* is making available to all instrument dealers kits of sample 45 r.p.m. records for each 45 r.p.m. phonograph shipped to the dealer.

The demonstration kits, available through distributors at no charge to dealers, contain seven records, each in a different color, to illustrate the feature of coding records by color to identify the musical classification they represent. Shipments of the kits are already underway to distributors for relay to their dealers.

Further details on this offer may be obtained from the *RCA Victor* distributor servicing your area.

ROTARY CONVERTERS

Janette Manufacturing Company of Chicago has just issued a new bulletin, #13-29, covering its line of rotary converters.

This 8-page booklet covers several types and models of converters and discusses in some detail the electrical and mechanical features of the line. Performance and operating characteristics are given in handy tabulated form. A "miscellaneous information" section provides valuable application hints.

Copies of this publication may be obtained from the company by writing to 556-558 W. Monroe Street, Chicago 6, Illinois.

WARD LEONARD RELAYS

Ward Leonard Electric Co. of Mount Vernon, New York has just issued a colorful new catalogue which lists its line of industrial and general-purpose relays which are carried in stock for immediate shipment.

Catalogue D-20A illustrates and describes the various types of relays, gives contact ratings, coil specifications, sizes, current list prices, and other helpful data on a.c. and d.c. units. It includes sensitive relays, midget metal base units, heavy duty midget relays, midget magnetic relays, heavy duty power units, thermal time delay relays and motor driven time delay relays. It also contains general information on the function of relays and the construction of the company's units.

A copy of Relay Catalogue D-20A may be obtained by writing the Electronic Distributor Division of the company at 53 W. Jackson Blvd., Chicago 4, Illinois.

-30-

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Catalog No. 501 FREE
PACKED WITH VALUES

1949 SUPREME MODEL 661
SIGNAL GENERATOR
$72.50 VALUE $36.88

5-BANDS. 2-DIAL SCALES on ILLUMINATED HAIR-LINE DIAL! Double calibration for ACCURACY. DUAL TUNING RATIO. ELECTRON COUPLED CIRCUIT; MAX. frequency stability, protected against shifts via line voltage, temperature, aging and humidity. Continuously variable FOUR STEP ladder multiplier—double shielded. R. F. RANGES of 65-205kc; 205-650kc; 650-2050kc; 2050-6500kc; 6.5-20.5mc; harmonics to 82mc! R. F. CARRIER 50% modulated at 400 cycles, may be cut off for unmodulated signal, 400 cycle A. F. with continuously variable voltage output min. to max. Jack provided for external audio-modulation. Steel gray wrinkle case 9¼ x 8 11/16 x 7⅜"; Wt. 15 lbs. Stock No. 35B35; "SUPREME" MODEL 661, $72.50 Value (Limited Quantity) SPECIAL EACH $36.88

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Intensive, specialized course, including strong basis in mathematics and electrical engineering, advanced Radio Theory and Design, Modern laboratory. Low tuition. Self-help opportunities. Also 27-month courses in Aeronautical, Chemical, Civil, Electrical and Mechanical Engineering. Gov't approved for G.I.'s. Enter Dec., March, June, Sept. Catalogue.
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TELEVISION RECEIVER—$1.00
Complete instructions for building your own television receiver. 16 pages—11" x 17" of pictures, pictorial diagrams, clarified schematics, 17" x 22" complete schematic diagram and chassis layout. Also booklet of alignment instructions, voltage and resistance tables and trouble-shooting hints. —All for $1.00.
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NEW! Original SIDE SWIPER KEY By J. H. BUNNELL
First post war delivery, just arrived $9.00
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0-200uA WH	$10.50	0-2AMP DC SIMP	$4.95
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0-1maDC WH	7.50	0-150VAC TRIP	5.95
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0-15maDC GE	3.45	0-75AMP AC TRIP	5.50
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2" METERS

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0-200ma GE	3.45	0-30VDC GE	3.45
0-1000ma	3.95	0-300VAC BURL	5.95

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6HY 50 MA 90 ohms	$0.39	8HY 160MA 140 ohm	$1.39
6HY 80MA 240 ohm	.75	4HY 250MA 90 ohm	2.75

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4MF 600VDC oil	$0.79	10MF 1000V oil	$1.39
10MF 600VDC oil	1.10	2MF 2000V oil	2.49
8MF 1000VDC oil	1.35	2MF 3000VDC oil	3.95
.01MF 1200V mica	.39	.005MF 2500V mica	.49
.002MF 2500VDC	.49	.01MF 15000V GA	32.50

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attaches to your automobile radio

continuous coverage 3 to 30 mc.

four working (r.f.) tubes

extremely compact

converter $39.95 noise silencer $8.25

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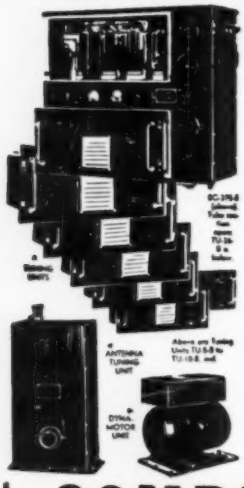

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Still Available —but Going Fast!

PUTS 150 WATTS ON THE AIR!

HERE'S WHAT YOU GET:

1—Xmitter BC-375-E, w/tubes, coverplate, meters, etc., & Mounts.
7—Tuning Units (TU-26-B, 200-500 kc.; '5-B, 1.5-3 mc.; '6-B, 3-4.5 mc.; '7-B, 4.5-6.2 mc.; '8-B, 6.2-7.7 mc.; '9-B, 7.7-10 mc.; '10-B, 10-12.5 mc.).
1—Antenna Tuning Unit, BC-306-A, w/Mount.
1—Dynamotor PE-73-C, w/Mount. Rating: in, 24-28 V.; out, 1,000 V., 350 ma., noise-filtered.
5—Connection Plugs.

Net wgt. of above, approx. 225 lbs.

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Made by General Electric to U. S. Army specs., for aircraft, ground and mobile use. Has Master Oscillator and Power Amplifier stages; its Tuners plug in for maximum efficiency. Pushes out plenty power for DX on 200 kc.-12.5 mc. (except 500-1,500 kc.). Use w/mike or key. (See *Radio & Television News, QST, CQ*, for modifying to 10, 20 mtrs.)

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Technical BOOKS

"VIDEO HANDBOOK" by Morton G. Scheraga & Joseph J. Roche. Published by *Boland & Boyce, Inc.*, Montclair, N. J. 881 pages. Price $5.00.

The co-authors of this text have tackled a big task in attempting to cover the entire field of television even in a book running almost 900 pages but seemingly they have done a good job, although some of the material is, of necessity, rather brief.

The handbook is divided into fourteen sections, the first being a resumé of television progress, past, present, and future. In succeeding sections the authors cover the fundamentals of electronic television, the television receiver, the TV station, antenna systems, creating a television show, a description of modern television receivers, installation, servicing, test equipment, building a television receiver, useful data including station allocations, a glossary of television terms, and a bibliography.

The text is well illustrated with photographs, circuit diagrams and line drawings. The writing is clear, concise, and easily-understood. This should prove to be a valuable reference work on the book shelves of students and technicians, as well as the layman interested in the "why's" and "wherefore's" of video.

* * *

"BASIC TELEVISION — PRINCIPLES AND SERVICING" by Bernard Grob. Published by *McGraw-Hill Book Company, Inc.*, New York. 588 pages. Price $5.00.

Because the author, an instructor at *RCA Institutes, Inc.*, is thoroughly familiar with the problems of teaching vocational courses in television, this text is especially suitable for the radio technician and the student.

Through his teaching experience, Mr. Grob has become familiar with the phases of television instruction which seem to cause the student the most difficulty. As a result these topics, such as phase inversion in an amplifier, a.v.c., rectifier circuits, modulation, and condenser action in a circuit, have received a most painstaking treatment in the text.

The author has assumed that the student is familiar with vacuum tube operation and conventional radio circuits and has a working knowledge of arithmetic and some simple algebra. In dealing with the subject of television, major emphasis is placed on receiver circuits because those using this text will probably be more closely concerned with receivers than with transmission equipment. Each subdivision of the television receiver is described in detail in an individual chapter with additional chapters devoted to the problems of deflection circuits and video amplifiers. A discussion of frequency modulation, as it pertains to

television systems, has also been included. Three appendices cover engineering standards, classification of television stations, and a table of frequency allocations.

Radio technicians who plan to enter the television field, as well as "old hands" at the video game, will find this book both instructive and enlightening. It is a "must" for the video service technician.

* * *

"BASIC ELECTRONICS" by R. G. Kloeffler with the assistance of M. W. Horrell. Published by *John Wiley & Sons, Inc.*, New York. 430 pages. Price $5.00.

This book has been designed to be used as an elementary textbook in electronics and covers such subjects as will best provide a springboard for more advanced studies in radio communication, wire communication, u.h.f., microwaves, and industrial electronics.

The text material covers physical concepts, electron emission, vacuum diodes, grid-controlled vacuum tubes, linear and nonlinear characteristics, vacuum tube amplifiers, multistage voltage amplifiers, power amplifiers, electron tube oscillators, modulation and detection, electrical conduction in gases, gaseous and vapor electron tubes, crystal and metallic rectifiers, rectification and inversion, photoelectricity, special photo applications, and special tubes and circuits.

Taken as a single unit, this book covers the fundamental theory of electronics in remarkably concise and easily understandable form. For the person with a good working knowledge of elementary physics, this book can serve either as a self-help text or can be used in regular courses of instruction. Check problems have been included at the end of each chapter.

* * *

"LEARNING ELECTRICITY AND ELECTRONICS EXPERIMENTALLY" by Leonard R. Crow. Published by *The Scientific Book Publishing Co.*, Vincennes, Ind. 525 pages.

This elementary text presents a new approach to the problem of teaching students the fundamentals of electricity and electronics. All of the material included in this book is presented by means of simple yet interesting experiments.

Since it has been proved time and again that this type of laboratory work is particularly conducive to quick learning, this book ought to serve nicely as a textbook for high schools, trade schools, and elementary college courses in physics. The required experimental equipment has been purposely kept simple and inexpensive with the emphasis being placed on the qualitative aspects of the experimental procedures rather than the quantitative results obtained.

Mathematics has been confined to simple arithmetical calculations and is used only where absolutely necessary. This book is suitable for self-instruction as well as classroom use. —30—

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6A6	.88	7Q7	.72	80	.50
6AE6G	.72	12A6	.99	89	.49
6B4G	1.06	12SA7GT	.49	485	.49
6B7	.59	12SF5	.60	954	.50
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New Intercom Markets
(*Continued from page 45*)

specialized selectors, which as an integral part of the master station permit the maximum leeway in changing the performance of the various units in the intercom system at any time after installation to give the user the exact performance he requires and to meet changing requirements.

The buyer may be assured, therefore, that whatever his initial system, it can be augmented or altered without scrapping or rebuilding equipment originally purchased. Consider the versatility of the new intercom: should the buyer desire, he may add six, twelve, twenty, thirty, or up to a total of forty stations to the same system, intermixed and each connected to as many master and staff stations as that master needs to contact. The selector takes care of all contingencies in the matter of increased requirements and provides up to forty-station capacity with only twelve selector buttons.

This simplifies the selling of intercoms because regardless of the salesman's initial recommendation in the matter of equipment, the basic purchase is such that it remains the nucleus of any augmented system.

As to specific recommendations, these fall into natural classifications. For example, the simplest home setup is the two-way system, consisting of a master and a substation. The application of this unit is endless. Mother can listen in on baby's room from the kitchen, or the occupant of an adjoining apartment can "baby-sit" by remote control. Or the set may be installed between front vestibule and kitchen; between kitchen and garage; bedroom and kitchen; rumpus room and living room; or any two-way combination required by the prospective purchaser.

Building from this basic master-and-staff setup, we consider the problem of kitchen contact with both the front door and baby's room (master and two staff stations); or let's assume Mother takes time out from kitchen chores to watch the living room television set or visit with a friend; meantime keeping an ear alerted for baby's cry and the front doorbell (two masters and one staff). If she wishes also to remain in speaking contact with back door callers or with the garage, a simple addition to the system is required. But the important thing to bear in mind is that any or all of these adjustments to individual requirements can be made quickly and economically from the original system.

In addition to tailoring the system to the buyer's exact needs, it affords him an opportunity to determine, while making use of the system, what changes, alterations or additions he wishes to make from time to time.

Office installations are comparatively simple to set up and augment. Using the master and staff combination, any number of units may be accommodated in any way required. In large offices, paging stations can supplement individual units. Bearing in mind that all staff stations can originate calls or respond, all personnel in an office can be reached immediately, individually or en masse, on any occasion needed.

In these installations, and more particularly in industrial or plant setups, key executive personnel may be placed in individual contact with each other and on conference calls, while each executive can talk to his own department. The sales department, for example, may contact the shipping room staff station to check on an order. This can be set up so that a shipping clerk may reply from a considerable distance from the unit—from atop a ladder, on the shipping dock, or any other remote place, without dropping whatever he's doing to proceed to a phone or unit.

In short, master and staff stations, boosters and paging units intermixed, can solve any possible intercommunications need, so that there is no conceivable obstacle which can stand in the way of a sale.

—30—

International Short-Wave

(*Continued from page* 101)

1030; has *English* from 0600; Sunday has church services 0530-0600; also heard on 4.780. (Cushen, N. Z.)

MALTA—The Forces Broadcasting Service, Middle East, has been testing on a number of frequencies. At the time this was compiled it had settled down on 4.782 with a schedule of 2330-0130 and 0430-1600; other frequencies used for tests include 7.220, 7.270, 6.140, 11.784, 11.850. *QRA* is *Forces Broadcasting Service,* Middle East, % Flight Commander, Headquarters, M.E.L.F., Malta Garrison, Malta. When tested on 11.784 around 1400-1500 or later, was heard in Conn. by Boice.

MALAYA—BFEBS, 11.88, Singapore, has *BBC* news relay 1100, leaves air 1130. (Dilg, Calif.)

MANCHURIA — Dairen heard on 12.420 rather weak; from 0730 takes relay from Peiping but does *not* take the *English* from Peiping 0830; also seems to relay Moscow at times; sign-off appears around 1000. Mukden heard on approximately 5.525, good signal; relays part of Peiping program but does *not* take *English* 0830. (Dilg, Calif.)

MEXICO—XEUW, 6.020, Vera Cruz, signs off 0100; announces sign-on for 1900. (McPheeters, N. Y.)

MONACO — Radio Monte Carlo, 9.785, heard 0100 sign-on, weak to fair on West Coast. (Balbi, Calif.) This outlet is good now in East some days around 1630-1700, but at times has bad *QRM* from the Soviet outlet on 9.78. (Bellington, N. Y.) Now has some *English* programs; asks for reports; some CWQRM at times. (Boice, Conn.)

MOZAMBIQUE—Lourenco Marques noted some time ago on approximately 15.24 around 1600 when announced in Portuguese; left air 1620. (Schild, N. Y., Boice, Conn.) Is listed on 15.24 as CR7BD. Heard by Brownless, England, opening on this channel 1700.

In addition to its 0430-0630 (midday) session, Beira also operates 1200-1530; good level in South Africa. (Ridgeway) Is listed 7.200. Ridgeway says Lourenco Marques has a *new* channel on 6.915 carrying Portuguese programs in parallel with other transmitters in (local) "evenings." I do not find this one listed.

NEW CALEDONIA—Radio Noumea in verifying reception of its *new* 3.400 outlet, stated this frequency is used for better reception in the interior of New Caledonia. (Cushen, N. Z.) Operates in parallel with the 6.000 channel around 0200-0500, although this is probably not complete schedule.

NEW ZEALAND—Radio New Zealand is now using a *new* channel of 6.080; recently, when closing on 15.28 around 0625, it was stated would be back 1300 on ZL7, 6.080 (however, call is officially listed ZL1 for this channel), 6.080, and ZL4, 15.280. The 6.080 channel provides excellent reception in

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COMPARE! FT-243. In ranges from 3mc to 9mc ..... ea. **79c**
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Cap.	Volt	Ea.	Per C
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225	15	.49	44.00
500	50	.59	53.00
40-20	150-25	.49	44.00
20-20	150-150	.53	48.00
30-30	150-150	.57	51.00
40-20	150-150	.59	53.00
50-30	150-150	.61	55.00
60-20	150-150	.62	56.00
75-75	150-150	.69	62.00
80-20	150-150	.64	58.00
80-40	150-150	.67	61.00
20-20-20	150-150-25	.58	52.00
30-30-20	150-150-25	.55	85.00
40-20-20	150-150-25	.63	57.00
40-40-20	150-150-25	.69	62.00
50-20-10	150-150-25	.67	60.00
40-40-40	150-150-25	.73	66.00
50-50-20	150-150-25	.75	67.00
50-50-40	150-150-25	.76	68.00
40-20-20	150-150-150	.67	60.00
40-30-20	150-150-150	.69	62.00
40-30-30	150-150-150	.73	66.00
40-40-40	150-150-150	.77	69.00
60-40-20	150-150-150	.77	69.00
80-20-40	150-150-150	.81	71.00
30	450	.49	44.00
40	450	.53	48.00
80	450	.57	51.00
90	450	.61	55.00
20-25	450-25	.51	46.00
40-20	450-25	.55	49.00
80-50	450-50	.65	58.00
15-15	450-450	.57	51.00
16-16	450-450	.61	55.00
30-30	450-450	.69	62.00
40-40	450-450	.79	71.00
8-8-25	450-450-25	.55	49.00
10-10-20	450-450-25	.59	53.00
20-10-50	450-450-25	.61	55.00
15-15-20	450-450-25	.61	55.00
15-15-40	450-450-25	.65	58.00
20-20-20	450-450-50	.71	64.00
30-30-20	450-450-25	.75	67.00
40-40-20	450-450-25	.83	75.00
40-40-40	450-450-25	.87	78.00
40-20-25	450-450-50	.77	69.00
20-20-60	450-450-350	.81	73.00
16-16-16	450-450-450	.79	71.00
20-10-10	450-450-450	.77	69.00
20-20-20	450-450-450	.89	80.00
40-10-10	450-450-450	.89	80.00
20-10-5-50	450-450-450-25	.71	64.00
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20-20-20-20	450-450-450-450	1.29	116.00
16	475	.44	39.00

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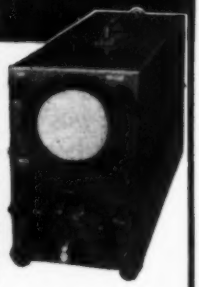
TELEVISION SCOPE



AR-3

SUPERIORITY AT A GLANCE!

The vertical response of this economy TV scope is usable to *5000* kc, not 50 kc. Response is flat to 750 kc, down 3 db at 1000 kc. Amplifier supplies a voltage gain of 20 at 5000 kc.

Check this necessary feature before you buy any scope for TV use.

The R.S.E., AR-3 Scope has been built by Ross Armstrong to our rigid specifications. It's a complete unit that embodies standard horizontal amplifier and sweep circuits with normal sensitivity.

The case is 8" high x 5" wide x 14" long, attractively finished in "hammered" opalescent blue enamel. Operates on standard 110 volts —60 cycles—40 watts. Tubes, 3BPI-6AC7-6SJ7-6X5-5Y3-884. Instructions included.

Complete specifications upon request. Satisfaction or your money back.

PRICE **$49.95** F. O. B. DETROIT

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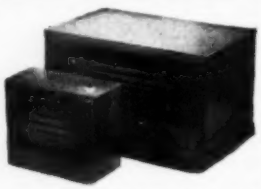
INTERCOM & RADIO

AT A PRICE THAT CAN'T BE BEAT



6 tube superhet—3 tube intercom permits communication between radio-master and up to 4 sub-stations.

Original cost $64.50

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With 1 sub-station and 50 feet of cable
Extra Sub-stations $3.95 each

PUSHBACK WIRE

25% BELOW MILL COST!

1st class, Essex or Lenz, ALL SOLID tinned copper, double cotton serve, waxed finish.

SIZE	COLORS	100 feet	1000 feet	Production Reel
22	BLACK-BROWN	.39	3.79	3.65M
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Australia around 0500-0630. (Hutchins, Radio Australia) Balbi, Calif., says ZL3 is no longer using 11.81, and that ZL4, 15.28, is used alone to 0200; ZL3 on 11.78 signs on 0200 and runs to 0430; ZL1, 6.080, has been heard by Balbi at 0435 (probably signs on 0430), and with BBC news 0600; ZL4 was in parallel with the 6.080 outlet when heard by Balbi.

William Yates, Director of the Short-Wave Division, informs me: "At the present time we are not proposing to extend our Short-Wave Service, and as we haven't an aerial array beamed to North America, I am afraid there is little chance of us starting a Service for that part of the world for some time to come. We have increased our program, *'Calling Australia and the Islands,'* by half an hour, so that it now covers the period 0200-0430; in addition, we broadcast a program of the Wellington stations of the New Zealand Broadcasting Service from 1300 to 0155 and from 0430 to 0620 each day."

NICARAGUA—YNDG, 7.660, Leon, *"Radio Colonial,"* now identifies frequently in *English;* logged 2130-2200 sign-off (Sunday sign-off is believed 2100); announced in Spanish a plan to increase power from present 330 watts to 1kw., in near future; also stated that around the first of 1950 expected to change frequency to about 5.925. YNEQ, 6.950, Managua, *"La Voz de la Victoria,"* noted 2230 to sign-off 2300. YNAT, 6.760, Managua, *"Radio Paz,"* heard 2200-2300 sign-off; announces sign-on as 1000. YNOW, 6.850, Managua, *"La Voz de la America Central,"* heard 2145-2200 sign-off. (McPheeters, N. Y.)

NORTHERN RHODESIA — ZQP, Lusaka, has weak signal on 3.914, is parallel on 7.20 which has strong signal; opens 1000 and relays *BBC* news 1100. (Ridgeway, South Africa)

NORWAY—In connection with the Students' Festival in Trondheim, a transmitter was to be on the air from October 1 to December 3. From October 1 to November 12 the broadcasts were scheduled 1700-1730 on Saturday and Sunday *only,* but from November 12 through December 3, the schedule was to be *daily* at 1700-1730; frequencies to be used were 6.185, 7.240. Power is approximately 600 watts and antenna effect approximately 400 watts. Signature tune was to be "Stars and Stripes." The station issues an attractive QSL card from Ukesenderen, Trondheim, Norway. Halvorsen, Norway, who reported the item to me, was trying to arrange for *English* as well as Norwegian announcements.

Radio Norway now broadcasts its Letterbox Program each Saturday in all transmissions; is in Norwegian and *English.* Current *Oslo* schedules for overseas are 2000-2100, LKV, 15.17, LKQ, 11.735, LLH, 9.645, to North American waters and North Atlantic; 0600-0700, LLP, 21.670, LLN, 17.825, LKV, 15.170, LKQ, 11.735, LLG, 9.610, to Far East; 0800-0900, LLP, 21.670, LLN, 17.825, LKV, 15.17, LKQ, 11.735,

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1 r.p.m. extremely powerful rotator. Reversing cam and switch. All leads brought to terminal board permitting great flexibility of connections. 28V. DC. ½" spline shaft. Totally enclosed.
Priced very low at only .... $5.95 ea.

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W-E, F1 unit only $1.50
American carbon button 49c
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Sigma 2000 ohm relay ..... $1.95 ea.
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Manufacturing Division of Video Television, Inc.

LLG, 9.610, to Indian Ocean; 1400-1500, LLP, 21.670, LLN, 17.825, LKV, 15.170, LLG, 9.610, to African waters and South Atlantic; 1800-1900, LKV, 15.17, LKQ, 11.735, LLH, 9.645, to South America. Powers are listed LKV, 100kw.; LLP, 5kw., and others, 10kw. (Halvorsen, Norway)

OUTER MONGOLIA—Ulan-Bator, heard on approximately 8.40 around 0930. (Balbi, Calif.) Listed 8.254. Dilg, Calif., believes schedule to be 0400-1000, and says is in dual with 5.265.

PAKISTAN — Radio Pakistan, 11.885, Karachi, still heard in East with news 0700 and 2100. Some days the 0700 news is readable over the Dacca relay station on 15.335. The 1015 news period is heard in California.

PANAMA — HOLC, 6.060, Panama City, "Radio Balboa," heard 2100-2200; announces QRA as No. 128 Avenida A, Panama City. Received verification recently for report sent in December 1948, from HP5H, 6.122; QRA given Apartado Postal 1045, Panama City; no power given; card shows modernistic facade of studio building with callsign. (McPheeters, N. Y.)

PARAGUAY—ZPA-5, 11.948, Encarnacion, noted 2000-2100 sign-off. (Sutton, Ohio)

PHILIPPINES—DZH6, 6.030, Manila, has been heard in Texas in *English* to 0630; had religious service; then went into foreign language, back to religious-type music 0645; identified 0700. (Stark) This station carries programs similar to those from *"The Voice of the Andes,"* HCJB, Quito, Ecuador; full schedule is 0500-0900 (and 2100-2300 on Sunday); has news when opens 0500 after "O, Hail the Power of Jesus' Name." (Cushen, N. Z.) Should be operating in other bands also by this time.

DZH3, 9.50, heard 0415 with sponsored program of music and news; DZH4, 6.00, heard 0515 with news round-up, weather reports, music; DZH6, 6.030, noted 0500 with news and music, good signal. (Sanderson, Australia)

POLAND—*Radio Polskie*, Warsaw, informs me it is planning a *new* 100kw. s.w. station for 1950 which will beam programs to the U. S. The recently-opened 200kw. station in Warsaw is operating l.w. in the 1340 meter band.

PORTUGAL—CS2MK, 11.027, Lisbon, heard 1715-1730. (McPheeters, N. Y.) May have been special broadcast.

PORTUGUESE INDIA—*Radio Goa* has replaced its 7.230 channel with 9.610; schedule is normally 0730-1030; closes down with Portuguese National Anthem. (Sampat, India)

ROUMANIA — Bucharest, 9.252, heard well in Newfoundland 1430-1545. (Peddle) At last report *English* news was 1500. Sink, New York, reports this one around 0100 in foreign language, woman announcer.

SOUTH AFRICA — Johannesburg, 4.895, noted 1545 with news and music, good level in Australia. (Sanderson)

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Large insulated Banana plugs	.09
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Jumbo plugs and jacks set	.12
4 watt wire wound pot. 25,000 ohms	.37
RS57 Sockets	.08
RS8 Sockets	.08
2x2 879	.49
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1.78 Mfd. 200VAC	oil	$ .29
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7.5 Mfd. 330VAC	oil	.69
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.05 Mfd. 2500VDC	oil	.95
1 Mfd. 5000VDC	oil	2.95
2x.1 Mfd. 7000VDC	oil	2.00
10 Mfd. 1000VDC	oil	1.95
.25 Mfd. 6000VDC	oil	1.69
.02 Mfd. 8000VDC	oil	.98
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P 67	1450—1450 1175—1175	1200 1000	300	5¾	6½	4	19.84
P 68	2100—2100 1800—1800	1750 1500	300	5¾	6½	4¼	24.99

* For dual operation with simultaneous use of both sec ratings. † Has 40-volt bias tap.

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Type 961	Dual 6.3VCT @ 3 Amps 2500V Ins	$3.38
Type 041	5VCT @ 3 Amps. 2500V Ins	$3.38
	6.3VCT @ 3.6 Amps.	

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C-83	8	C-90	3—14	300	$5.59

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2 piece 5-pole Male and Female Separable plug. Both with Flex. Cord. 4 prs. $1.00
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5"—450 ohm AC-DC dynamic. $1.35 Philco rotary tap
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Telegraphs, Salisbury, states that no high frequency transmissions are as yet in operation on a permanent basis; however, as soon as test transmissions have been completed, broadcasts are to be radiated on either of these channels—3.320 or 4.890 local nights, and 6.120 or 7.290 local days; the transmitter is a STC type C.M.-5, 15kw., twin-channel, tropical frequency broadcast transmitter, using omni-directional antennas. (Ridgeway, South Africa) Call listed ZEAF for 3.320, and listed ZEAH for 4.890; I do not find others listed.

SPAIN AND POSSESSIONS — "SEU," 7.173 (measured), Madrid, noted 1720, fair signal, announcements in Spanish. (Ferguson, N. C.)

Ken Dobeson, London, British representative of *Radio Nacional,* Madrid, airmails these Winter Time schedules and other current data on Spanish broadcasting:

Radio Nacional, 9.368, 40kw., Madrid, Italian 1230; Roumanian 1245; Portuguese 1300; Russian (jammed) 1320; French 1400; Polish 1430; Hungarian 1500; *English* now 1515; Spanish 1545; German 1630; Arabic 1645; closes 1715; *English* for North America 1800-1830, beamed, reports welcomed; Spanish to South America 1845-2200; Spanish to Philippines 1715-1750; Spanish for Europe (relay of m.w. program on 1022kc., 120kw.) 0700-1100. *Radio Nacional,* 15.635, 40kw., Madrid, Spanish to South America 1145-1220. The four projected 100kw. transmitters will *not* be completed until next year (1950). *Radio Nacional de Espana en Malaga* is now off the air on s.w.; is now using a *new* m.w. 8kw. transmitter; Malaga was on 7.025. *Radio Nacional de Espana en Cuenca* is now using only m.w. (old s.w. channel was 7.100). *Radio Falange de Alicante,* 7.940, 0700-0930, 1400-1800. *La Voz de la Falange,* Madrid, 7.380, French 1630; Spanish 1700-1830. *Radio "SEU,"* 7.171, Madrid, 0800-1100, 1530-1930. *Radio Mediterraneo de Valencia,* 7.037, 0700-1000, 1400-1800. *Radio Falange de Valladolid,* 7.006, 0730-0930, 1500-1730. Balearic Islands, Radio Menorca, 7.520 to 7.550 (varies), Mahon, 1430-1630. Spanish Guinea, Radio Atlantica, projected 200kw. transmitter will *not* be operating until 1950; when in Madrid recently, Dobeson talked with one of the directors of the company and secured this information; however, he learned that a *"small"* transmitter will be working soon, details unknown; it should be on the air yet this year, probably by this time; ultimately, this low-powered sender will be used for beamed communications with Headquarters in Madrid for necessary program deviations and the like. Spanish Morocco, *Radio Tetuan* is still on 6.067 in Spanish and Arabic; no schedules listed by Dobeson.

SWEDEN—A new series of programs in *English* dealing with international student problems is broadcast the second Sunday of each month from *Radio Sweden* at 0230 on 6.065, 10.78, and is repeated 1030 on 10.78,

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GT type. Cartoned and guaranteed.

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1U5	35W4	6BA6	6AQ6	117Z3
3A4	35B5	6BE6	6C4	19T8
1S5	50B5	6AT6	6X4	6BJ6
3V4	12AT7	6AL5	6W4	6BA7
3Q4	12AU7	6AQ5	6AG5	6BJ6
3S4	12AX7	6BF6	6AU6	35C5
12BA6	12BA7	6AU7	6BG6	31

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Top cowl ear antenna less lead-in 3 section 89c ea.
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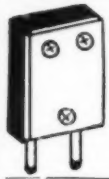

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15.155, and again 2030 on 6.065, 10.78. (Radio Sweden)

Winter Time schedules of *Radio Sweden* are 1900-2030 on 6.065, 10.78; 0015-0230, 6.065, 10.78; 0230-1010, 11.705, 15.155; 1015-1255, 10.78, 15.155; 1255-1700, 6.065, 10.78. (There usually are interval breaks on weekdays 0230-0600, 0900-1015; time of the program *Sweden Today* is changed to 0815 and repeated at 2000. (Skoog, Radio Sweden)

SWITZERLAND — United Nations Radio, 6.672, Geneva, still heard 1330-1340 with *English* news; French news 1340-1350. (Nordh, Sweden) May be off Sundays.

Worris, N. Y., furnishes these complete Winter Time schedules of the *Swiss Short-Wave Service;* now transmits on HER3, 6.165, HER4, 9.535; HEU3, 9.665; HEI5, 11.715; HEU5, 11.815; HER5, 11.865; HED7, 15.120; HER6, 15.305; HEI7, 15.320; HER7, 17.784, and HER8, 21.520. Operates to Eastern Australia, New Zealand, Japan, 0215-0400 on HEI5, HER5, HER6. To Western Australia and Far East 0400-0445 on HEI5, HER5, HER6. To South-East Asia 0745-0930 on HER5, HER6, HER8. To India and Pakistan 0945-1130 on HER5, HER7. To the Middle East 1145-1330 on HEU3, HER5. To the United Kingdom and Ireland 1345-1530 on HEU3, HER5. To Spain and Portugal 1545-1715 on HEU3, HER5. To North America (first daily transmission) 1730-1815 on HER4, HEU5, HEI7. To Latin America 1830-2000 on HER4, HEU5, HED7; to North America (second daily transmission) 2030-2215 on HER3, HER4, HEU5; to North America (third daily transmission, particularly for Pacific Coast area) 2215-2300 on HER3, HER4, HEU5. To Europe 0015-0140 (*except* Sunday), and 0055-0140 (Sunday *only*), 0500-0830 (*except* Saturday, Sunday), 1030-1700 (*except* Saturday, Sunday), 0500-1700 (Saturday *only*), 0245 or 0300-1700 (Sunday *only, alternating*) on HER3, HER4. To Africa (in parallel with European sessions) at 0015-0140 (*except* Sunday), 0055-0140 (Sunday *only*) on HER5; 0500-0730 *daily* on HER8; 1030-1700 on HEU5 *daily;* all *except* the European-African transmissions are *daily.*

"Switzerland Calling" is the title of the program booklet issued by *SBC;* contains programs and schedules for the Winter period (to April 1, 1950), and is mailed free on request from *The Swiss Short-Wave Service,* Neuengasse 30, Berne, Switzerland. (Radio Sweden)

SYRIA—Damascus, 12.000, heard 1400 with news. (Grove, Ill.)

THAILAND—Bangkok, 11.65, heard 0615 with news; heard on both 11.65 and 6.01 at 0715 with news. A station heard on 4.754 recently 0715 announced as *Radio Siam* and had news in Thai. (Sanderson, Australia) In the 0700-1005 native transmission, Bangkok is now using 11.650, 7.105, 6.010, all audible in California. Sometimes runs as late as 1030, however. (Dilg, Calif.)

TURKEY — TAP. 9.465, Ankara,

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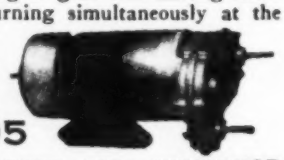

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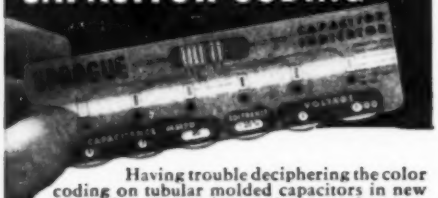

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MN26Y Compass. Used **$3.95**. Plug **95c**
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Dual-section volume control. New **$2.25**
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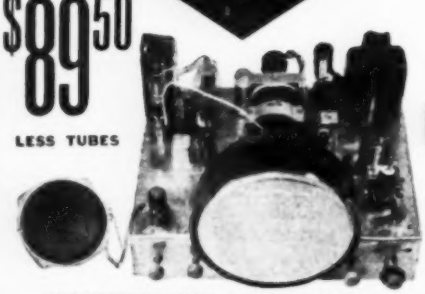

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noted with strong signal 1545 to 1600 when announced in *English;* march or anthem followed, then left air. (Bellington, N. Y.) Is now on Winter Time schedule; TAP has news daily 1445. (Pearce, England) At the time this was compiled the Sunday *Mailbag Program* was at 1630 over TAQ, 15.195, and the same outlet was in use on Thursdays 1630-1700 for the *English* talks feature; however, by this time probably will have moved these transmissions to TAP for the winter. TAP noted in California 1000 when announced in *English* according to Balbi.

URUGUAY—CXA-10, 11.90, Montevideo, *"Radio Electrica,"* noted signing off 1900. (Bellington, N. Y.)

USA—The "Voice of America's" Radio Amateur Program is now scheduled on Sundays to the Far East 0830 in the 6, 9, 11, 15, and 17 mc. bands; to South America 0830 in the 15, 17 mc. bands, and to Europe 1415 in the 13, 16, 19, 25, 31, 41, and 49 meter bands. (Lyttle, Ontario)

USSR—Moscow, 7.330, is good level afternoons; French 1600-1630; *English* 1630-1730. (McPheeters, N. Y.) Moscow heard in Sweden on 15.390 at 1420 with news. (Nordh)

VATICAN—HVJ, 15.095, noted with good signal 1000 with news; announced operating also on 11.740, 9.643; by now probably has changed to Winter Time schedule with news 0900; the 1315 news period should remain at same time, however, over 11.74, 9.643, 5.969.

VENEZUELA — Radio Caracas, 4.920, heard 2000-2030; often plays recordings in *English.* (McPheeters, N. Y.) YV5RU, 4.850, Caracas, now has daily *English* newscast at 1845. YV5RM, 4.890, has daily half-hour show of American dance music; (no time given). (Balfe, Mass.)

YUGOSLAVIA — Radio Belgrade, 9.508, heard 0115 with news and at 1115 with news on 6.100. (Nordh, Sweden) Confirmed by Pearce, England.

* * *

Last Minute Tips

The Communist-controlled Chinese station heard mornings on 9.740 is definitely announcing as Hankow, and the one on approximately 5.985 is announcing as Shanghai, signs off 0900. A Chinese outlet heard with weak signal on approximately 9.99 is believed Shanhai, heard to 1000; is *not* in dual with the 5.985 one; however, the 9.99 outlet *is* in dual with Nanking, 9.732, most of the time but *not* during the *English* relay from Peiping 0830. The 9.740 outlet now remains on after 1600. (Dilg, Calif.)

Sanderson, Australia, reports the *new Radio Malaya* outlet of the Blue Network on 9.712 has been heard 0400 with program details, then news, and music; location is Singapore. Dilg, Calif., hears this one in *English* 0900-0915; gives QRA as Box 434, Singapore.

Winter schedules of the *SABC,* South Africa, just received via airmail, include: Johannesburg—3.450, not operating; 4.895, 2345-0130 (week-

days), 0055-0130 (Sunday), 1200-1605 (weekdays and Sunday), 1200-1645 (Saturday); 6.007, not operating; 9.523, 0315-0710 (weekdays), 0900-1150 (weekdays), 0315-1150 (Saturday and Sunday); 11.710, not operating; 4.800, 2345-0130 (weekdays), 0055-0130 (Sunday), 1140-1605 (weekdays and Sunday), 1140-1645 (Saturday); 9.870, 0315-0710 (weekdays and Sunday), 1140-1645 (Saturday); 3.290, not operating; 6.095, not operating; 4.373, all sessions. Cape Town—5.88, 1200-1605 (daily), 2345-0130 (weekdays), 0055-0130 (Sunday); 9.61, 0315-0710 (weekdays), 0900-1145 (weekdays), 0315-1145 (Sunday). Pietermaritzburg — 4.878, all session (exchange station at 1215-1500 on Monday).

Swedes report a station speaking to Esthonians abroad, heard on approximately 7.610 daily 1030-1100; seems to be situated at Tallinn and trying to persuade Esthonian immigrants—especially those living in Sweden—to come back to the Soviet Union. (Radio Sweden) Could this be *Radio Volga*, Berlin, listed on this channel, under Soviet control?

The North Korean outlet formerly 4.440 has moved to approximately 4.500; heard mornings in parallel with 7.786. (Dilg, Balbi, Calif.)

Radio Indonesia, Batavia, Java, D.E.I., sent these schedules—*English*, 0600-0700, YDC, 15.15, PLB9, 11.000, YDB3, 7.27, to Australia, New Zealand, Malaya, and India. French, 1000-1100, YDC, 15.15, YDE, 11.77, PLB9, 11.000, YDB3, 7.27, to Indo-China; 1100-1200, PLD6, 17.63, to Middle East, and 1200-1300, PLF2, 19.34, to Europe. Dutch, 1100-1200, YDC, 15.15, and 1100-1130 (Forces), PLF2, 19.34, to The Netherlands. Arabic, 1200-1300, PLD6, 17.63, to Middle East.

Experimental transmissions are heard from a station located at Parma, Italy, at 1500 to sign-off 1530, on 7.590. (Radio Sweden)

Radio Tetuan, 6.067, 1.5kw., is operating weekdays at 0230-0300, 0830-1000, 1300-1800 and Sundays 0830-1000 and 1430-1800, according to *Radio Sweden*.

Radio Polskie, 9.53, Warsaw, Poland, noted daily *except* Friday opening 0000 with a song; all-Polish with classical music; at 0030 plays 7 or 8-note chimes, then has setting-up exercises; closes down around 0315; best to 0100, however. A station heard on about 10.060 opening 0130 weekdays and around 0020 on Sundays with Arabic, is possibly Cairo. (Hagen, Ala.) The latter also reported by Bellington, N. Y.

Bucharest, 9.252, Roumania, picked up opening 0055 with native song; 0100 had Roumanian news by woman; closed 0125 without any musical signature. (Hagen, Ala.)

* * *

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—30—

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7193/2C24	6BA6	57	50Y6G	50L6
E1148	6BE6	76	53	2050
VT52	6C5GT	78	56	2051
19c Each	6C6	80	117Z3	350B
57AS	6F6G	85	**50c Each**	75
1644	6H6GT	G84	1A5GT	**59c Each**
V99	6J7	**45c Each**	1A6	01A
X99	6K6GT	1B5/25S	1A7GT	0Z4
29c Each	6K7G	1L4	1C6G	1LA4
2A7	6K7GT	1R5	1C7G	1LC6
2X2	6N4	1S4	1D7G	1LD5
6C4	6SA7GT	1S5	1D8G	1LE3
6C8G	6SC7	1T5GT	1E7G	1LH4
6SH7GT	6SD7GT	2A5	1F4	1LN5
6SR7GT	6SF5GT	2B6	1F5G	1N6G
6U7G	6SF7	3B7	1G4G	1T4
7Y4	6SJ7	3Q5GT	1G5	5V4G
12A6	6SK7GT	6AL5	1G6GT	6AB5G
12AS8GT	6SQ7GT	6BJ6	1H4G	6AB7
12F5GT	6U6GT	6D7	1H5GT	6AG5
12H6	6V6GT	6F5GT	1H6G	6B4
26	6X4	6G6G	1J6G	6BF6
36	6X5GT	6P5GT	1N5GT	6BG6G
956	12AU6	6R7GT	1R4	6BH6
957	12AV6	6S7GT	3D6	6J6
8011/VT90	12J5	6SL7GT	3Q4	6J8G
HY615	12J7GT	6SN7GT	3S4	6U5/6G5
RK72	12K7GT	6SS7GT	3V4	6W4
RKR72	12Q7GT	6V5	5Z3	6W6
RKR73	12SA7GT	6Y6G	5Z4	6Y3
VT25	12SF5	7A4/XXL	6A5G	12A
39c Each	12SH7	7A8	6A6	12AT7
1A8	12SK7GT	7B6	6AQ5	14A7
1U4	12SL7GT	7E5/1201	6B6G	14Q7
1U5	12SN7GT	7K7	6B8	14R7
1V	12SQ7GT	12AT6	6D6	22
2A6	19T8	12AU7	6D8	70L7GT
3A4	24A	12BA6	6F8G	**69c Each**
4A6	25Z6GT	12BE6	6L5G	6AC7/1852
5U4G	27	12SJ7GT	6Q7G	6AG7
5W4	32	12Z3	6T7G	6AK5
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5Y4G	35Z5	32L7GT	7Q7	6L6G
	35Z6	84	12BD6	830B
			12C8	

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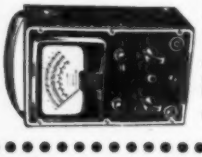

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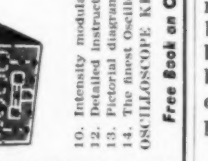

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Waveform Analysis

(*Continued from page* 58)

voltages in the plate circuit of the 6BG6G and in the primary of the output transformer are on the order of 5 to 9 kilovolts. Extreme care must also be employed when making these measurements, as the scope ground is actually at the "B+" potential of the receiver. Avoid physical contact with the scope and receiver chassis or accidental ground between the two.)

The normal course of the television signal can be traced from the detector output to the kinescope grid by following the waveform patterns shown in Fig. 1. To better understand what takes place in the various stages, suppose we run very briefly through the schematics in Figs. 2 and 3. The composite video signal in Fig. 1A and 1B (containing video signal, blanking, and sync pulses) is fed from the video detector output through two stages of video amplification. In this particular case, the picture phase is *negative* (the dense white area at the top representing the video component, while the black area just below the faint downmost tips of the video signal is the blanking or black level). The sync or blacker-than-black region is the area below the horizontal base lines. Two of the sync pulses can be seen in each photo.

In receivers whose video detector is connected differently, the picture phase may be positive (pictures in Figs. 1A and 1B inverted). The signal at the grid of the second video stage (Fig. 1C) is substantially the same except that it is inverted 180 degrees and has assumed a peak-to-peak voltage gain of 1.3 volts. At the second video output this gain has increased to 6.4 volts. Referring to the schematic (Fig. 3), the video signal is taken from the second video output and fed both to the kinescope grid and to the input of the d.c. restorer and sync separator. Here the sync pulses are removed from the composite video signal and passed on to the pulse stabilizing amplifier, where they are amplified.

This stage operates in a manner similar to a compression or a.v.c. stage so that the sync pulse amplitude at its output is practically constant for a wide range of input voltages. The pulse stripper (or clipper) clips the signal at just above the blanking level and removes all of the remaining video component from the sync pulses. The pulse limiter flattens the top of the vertical pulses so that a good, square-shaped pulse will be applied to the integrator and thus to the blocking oscillator. The blocking oscillator and discharge tube feeds in the usual manner into the vertical output stage, which converts the voltage waveform into a current waveform and applies it to the vertical deflection coils.

In the horizontal deflection system, a.f.c. is used. This consists of a 6V6G sine wave oscillator operating at 15,750 c.p.s. with a 6AC7 reactance tube across its input circuit. The horizontal sync pulse is combined with the sine wave voltage in the 6H6 discriminator to produce a d.c. voltage which biases the reactance tube and causes the oscillator frequency to sync with that of the sync pulses. The horizontal discharge and horizontal output operate in a manner similar to the vertical discharge and output stages, except for

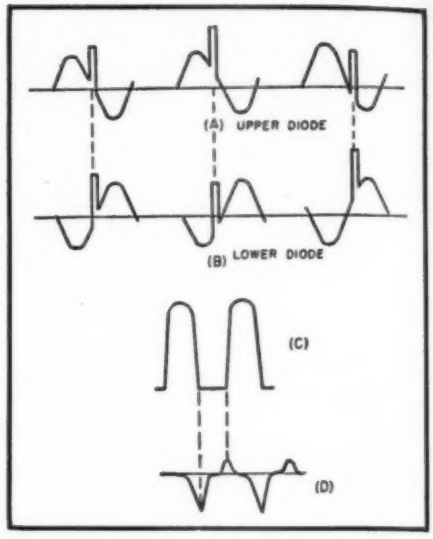
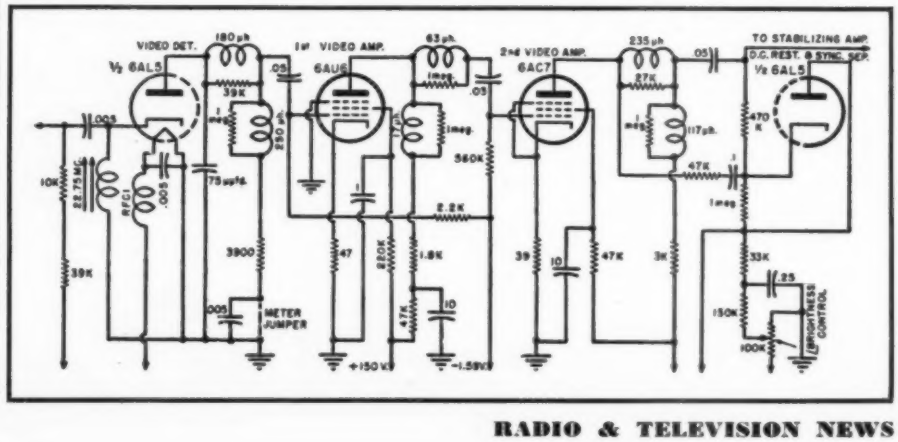


Fig. 4. Note how closely the theoretical waveforms in Figs. 4A, 4B, 4C, and 4D compare with the actual waveforms illustrated in Figs. 1VV, 1WW, and 1X (Page 57) respectively.

Fig. 3. Partial schematic of the Motorola VK101 and the VK101M television receivers.



the higher frequency and the increased voltages involved.

Waveform Interpretation

Proper analysis of these waveforms will greatly facilitate servicing. For instance, if a video signal is present at the kinescope grid, but no waveform is present in either the vertical or horizontal sync stages, look for a defective stabilizing amplifier, pulse stripper, or pulse limiter; these three stages are all common to both horizontal and vertical deflection circuits. Check for the presence of waveforms in each stage. Presence of vertical sync, but no horizontal sync, indicates possible trouble in the discriminator or reactance stages. Other troubles can be traced in the same manner simply by checking for the presence of a waveform and comparing it to the standard just as we have been doing. By studying the operation not only of the sweep and sync circuits, but of the entire receiver by the waveform comparison method, the action and correlation between each section will soon be understood, and the service technician will be able to diagnose and correct the trouble in the least possible time.

Diagrams, waveform photos, and part of the material contained in this article are included with the permission of *Motorola, Inc.*

—30—

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THE service technician is often cautioned against the use of oil in radio and television repairs, because a greasy area around radio frequency terminals can cause signal attenuation. This admonition does not, however, apply to the shafts and bearings of turret tuners in television receivers, or to variable condensers which have wiper springs for making electrical contact.

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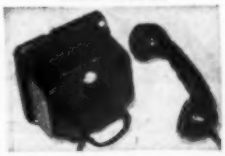

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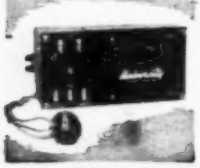

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A.G.C. System

(*Continued from page 74*)

and 20B1 is found in the new *Videola* receiver (Fig. 3) made by *Tech-Master Prod. Co.* Using a single 6AC7 video amplifier, the a.g.c. voltage is obtained through a voltage divider and decoupling network consisting of a 4700, 1800, and 47,000 ohm resistor. The contrast control is the same as in the *Admiral* model, but the method of obtaining the flyback pulse is different. Here a special tap has been incorporated in the horizontal flyback transformer and the pulse is coupled from that tap through a 1200 $\mu\mu$fd. condenser to the plate of the a.g.c. tube. The filter and voltage divider network for the a.g.c. bias are also different, providing a short time constant for fast a.g.c. action.

Actual field tests of this circuit in the New York area show greatly improved noise characteristics especially on Channel 13 which is received poorly in many locations. A.g.c. bias voltages varied from 5 to 2 volts negative from Channel 4 to Channel 13 in one location where the former is received with about 5000 microvolts, and the latter with about 75 microvolts signal strength.

The service technician who wants to incorporate keyed a.g.c. into a customer's set faces a number of problems, each of which can be solved with some ingenuity and television know-how. The first problem is to add a tube and to find space for it. In many receivers the second detector is a 6AL5 duodiode of which only one diode section is used. Substituting a crystal for the 6AL5 will provide a suitable miniature socket for the 6AU6 a.g.c. tube. The most frequently used crystal is the 1N34 germanium diode, although some of the new welded crystals made by *General Electric* and others are also good for this purpose.

If a new hole for the a.g.c. tube has to be made, it should be located close to the video amplifier from which the picture signal will be obtained. The actual wiring changes necessary depend on the type of video amplifier used, but the need for a d.c. level and positive sync pulses must be kept in mind. See the section "Pulse and Voltages" for details. Some kind of decoupling resistor must be used to prevent loading of the video amplifier with the tube capacity of the a.g.c. tube. The a.g.c. bias filter and voltage divider network may require some changes when television signals are applied, either to give more bias or less to the stages it controls.

The greatest problem for the service technician is to obtain the flyback pulse with a minimum of changes and parts substitution. Unless a tapped flyback transformer, or one having a special winding for the a.g.c., are easily obtainable, the best method will be to wind another coil over the horizontal width control. Winding a few

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Troubleshooting

When servicing or troubleshooting a system of keyed a.g.c., the main features to keep in mind are as follows:

(1) A positive sync pulse of 15,750 c.p.s. frequency must appear on the grid of the a.g.c. tube.

(2) A d.c. connection must exist between the video amplifier and the grid and cathode of the a.g.c. tube, and either a d.c. restorer or a direct connection to the second detector must be present.

(3) The grid of the a.g.c. tube must be about 3 to 5 volts negative with respect to the cathode.

(4) The oscilloscope should show a positive pulse on the plate of the a.g.c. tube, the peak amplitude of which should be about 20 to 50 volts higher than the cathode potential.

(5) The screen of the a.g.c. tube should show a d.c. voltage approximately equal to the peak plate potential.

(6) The a.g.c. bias voltage should be d.c. only, varying from about 2 to 5 volts negative.

(7) Changing the signal strength at the antenna should bring an instant change in a.g.c. bias voltage.

(8) Do not expect the keyed a.g.c. to operate when the horizontal sweep is not synchronized to the incoming picture signal.

In conclusion it should be said that the use of keyed a.g.c. will eliminate a number of problems now plaguing the viewing public. In addition to giving better noise response on weak signals and eliminating airplane flutter and similar sources of signal fading, keyed a.g.c. systems have another advantage which is immediately apparent even to the layman.

In receivers having no a.g.c., many service calls are due to too much contrast, which in turn causes tearing, jumping, and even reversed picture polarity. Keyed a.g.c. completely eliminates this problem. In most locations it is not necessary at all to adjust the contrast controls for each station, but once set properly, contrast and brightness controls can be completely forgotten. The customer just switches channels and tunes for the best picture and sound. This is a great sales feature as well as a help to the harassed service technician. Many of them will be anxious to add keyed a.g.c. to receivers already sold, because getting better and steadier pictures means more satisfied customers.

—30—

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1U5	6BE6	12AX7	9002
3A4	6BF6	12BA6	9003
3Q4	6BH6	12BA7	954
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6C6	6SL7GT	12A8GT	25L6GT
6J6	6SN7GT	12J5GT RCA	25Z6GT
6P5GT	6SQ7GT	12SA7GT	32L7GT
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AFCA NEWS

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AFCA CHAPTER NOTES

Atlanta

Atlanta was the third chapter to hear Dr. J. O. Perrine, Assistant Vice President of the *American Telephone and Telegraph Company*, deliver his demonstration-lecture on "Micro-Radio Waves in Civil and Military Communications." Dr. Perrine was the principal speaker at the annual fall dinner-meeting of the chapter on September 6th at the Officers' Club, Fort McPherson. He was introduced to the assembly by Mr. Hal S. Dumas, President of *Southern Bell Telephone and Telegraph Company.*

Among those present were: Lt. Gen. Alvin C. Gillem, Commanding General, Third Army; Maj. Gen. Paul J. Mueller, Deputy Commanding General, Third Army; Maj. Gen. William C. Chase, Chief of Staff, Third Army; Col. Frank Ward, Deputy Post Commander, Fort McPherson; Col. R. P. Lyman, Signal Officer, Third Army; Brig. Gen. William L. Plummer, USAFR; Lt. Col. George H. Kneen, Commanding Officer, Marietta Air Force Base; Capt. E. C. Parker, USN, Commanding Officer, U. S. Naval Air Station, Atlanta; Mr. J. G. Bradbury, Executive Vice President, *Southern Bell Telephone and Telegraph Company.*

Augusta-Camp Gordon

Dr. J. O. Perrine's appearance before the Augusta-Camp Gordon Chapter on September 1st drew a record audience of 650 at Theater No. 1, Camp Gordon. The local press reported it as "one of the most amazing demonstrations ever seen here of the progress being made in the transmission of electrical energy and the transformation of this force into light and sound."

Prior to the lecture, Dr. Perrine was guest of honor at a dinner given by the chapter at the Camp Gordon Officers' Club.

Baltimore

The October meeting of the Baltimore Chapter was held at the U. S. Naval Academy, Annapolis, on October 19th. After dinner at the Officers' Club, the members attended a lecture on electronics and electricity, as covered in the Naval Academy course. This was followed by a visit to the Electrical Engineering Laboratory.

The program was arranged by Rear Admiral James L. Holloway, Jr., Su-

The Chicago Chapter group aboard a Patrol Craft Escort vessel en route to U. S. Naval Training Center at Great Lakes, Ill., where the September meeting was held.

perintendent of the Naval Academy; Capt. William R. Smedberg, Head of the Academy's Department of Electrical Engineering; and Capt. Richard E. Elliott, Commanding Officer of the U. S. Navy Communication Station, Annapolis.

Chicago

The Chicago Chapter held its September meeting at the U. S. Naval Training Center, Great Lakes, Ill., on the evening of September 21st. Through the courtesy of Capt. Valvin R. Sinclair, USN, Inspector Instructor of Chicago and Evanston Naval Schools, a Destroyer Escort vessel was provided to transport one hundred members and guests to the Great Lakes base. The PCE 894, under command of Lt. H. E. Graven, USN, left Naval Armory in Chicago in mid-afternoon, arriving at Great Lakes in time for a tour of the base before dinner at the Officers' Club.

Chapter president Oliver Read presided at the meeting, introducing as speakers U. S. Naval experts on electronics supply and training. Capt. W. M. Foster, USN, keynoted the meeting with a short talk on the Naval objective of making as easy as possible the work of firms supplying new and old items of equipment. Commander C. R. Eagle, Jr., USN, executive officer of the Electronics Supply Office, briefly outlined the facts about the purchasing office, and indicated high points of interest to be seen in the tour after the meeting. Commander A. B. Chase, USN, described some of his problems as Technical Officer of the Electronics Supply Office. Lt. Commander N. A. Garretty, USN, Officer in Charge of the Electronics Technicians School, gave facts about the installation for training of maintenance men on radar, sonar, and communication equipment.

After the short talks, the meeting was adjourned to form convenient groups to tour the Supply Office and the Training School. The Training School equipment was spectacular in its twelve million dollar installation designed to graduate 250 to 300 men per month with a 42-week course of instruction.

Detroit

The first fall meeting of the recently organized Greater Detroit Chapter featured a demonstration-lecture on the Air Force's tri-dimensional photography show by Col. George W. Goddard, USAF, Chief, Photographic Laboratory, Engineering Div. The meeting was held on October 6th in the *Detroit News-WWJ* auditorium.

AFCA vice-president T. S. Gary, *Automatic Electric Co.*, officially presented the chapter charter to chapter president R. J. McElroy of *Michigan Bell Telephone Co.*

Kentucky

"Communications as a Crime Stopper" was the topic of the October 14th meeting of the Kentucky Chapter at the Lexington Signal Depot. The sub-

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1A7GT	2A6	6AC5GT	6F8	6SJ7	7B6	12K7	25AC5	50B5	VR150
1B5	2A7	6AF6G	6H6	6SK7	7C4	12K8	25L6	50C5	182B
1C5GT	3A4	6AG5	6J5	6SL7	7C5	12Q7	25Z6	50Y6	183
1C6	3A5	6AK5	6J6	6SN7	7F7	12SA7	26	51	482B
1D8	3B7	6AL5	6J7	6SQ7	7H7	1201/7E5	27	53	483
1G4	3D6	6AQ5	6J8	6SR7	7Y4	12S8	30	56	954
1H5	3Q4	6AT6	6K6	6SS7	7Z4	12SC7	31	57	955
1H5GT	3Q5	6AU6	6K7	6ST7	10Y	12SF5	32L7	58	956
1J6	3S4	6AV6	6K7G	6SU7	12A6	12SF7	35	70L7GT	957
1J6G	3V4	6B4G	6K8	6T7	12A8	12SG7	35/51	71A	1005
1L4	5R4G	6B8	6L6	6T8	12AT6	12SH7	35B5	75	1626
1LC6	5T4	6BA6	6L7	6U6G	12AT7	12SJ7	35W4	76	1629
1LH4	5T4G	5BA7	6N7	6U6GT	12AU6	12SK7	35Z5	77	2051
1LN5	5U4G	6BE6	6P5GT	6U7	12AU7	12SN7	35Z6	78	2050
1N5	5V4	6BF6	6Q7	6V6	12AV6	12SQ7	36	80	9003
1Q5	5W4G	6BG6G	6R7	6W4	12AX7	12SR7	37	81	CW931
1R4	5X4	6BH6	6S7	6W7	12BA6	12Q7	38	83	307A
1R5	5Y3GT	6BJ6	6S7G	6X4	12BA7	12Z3	39/44	84/6Z4	9001
1S5	5Y4G	6C4	6S8	6X5	12BE6	14A7	40	85	
1T4	5Z3	6C5	6SA7	6Y6	12BF7	14Q7	41	89	
1T5	5Z4	6C8G	6SC7	6Y7	12C8	14X7	42	117P7	
1U4	6A3	6D6	6SD7	6ZY5	12F5	19	43	117Z3	
1U5	6A4	6D8	6SF5	7A4	12H6	19T8	46	117Z6	

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ject was presented by two state officials—the Commissioner of Kentucky State Police, Mr. Guthrie Crowe, and his Communications Chief, Mr. Henry C. Hall.

New York

The first fall meeting of the New York Chapter was a "Navy night." Members and guests met for dinner at the Officers' Club of the Brooklyn Navy Yard on October 5th. The guest of honor was the new Chief of Naval Communications, Rear Admiral John R. Redman, who had come up from Washington to address the chapter.

Sacramento

A composite picture of "Local Military Signal and Communication Establishments" was presented at the September 27th meeting of the Sacramento Chapter at the Sacramento Signal Depot Officers' Club. Short talks and demonstrations were given by speakers from each of the following activities: Sacramento Signal Depot; 6205th Sig. CRAU-RES; 972nd Sig. Hdq. Const. Co.-Res.; Mather Air Force Base; 146th AC & W Sqdn.-National Guard; Naval Reserve Area Communications; Coast Guard Reserve; 184th Infantry-National Guard; 636th Field Arty. Bn.-National Guard; McClellan Air Force Base; and 22nd Air Force SC-Reserve.

St. Louis

The St. Louis Chapter held a dinner-meeting on September 30th at the Mark Twain Hotel. The program consisted of two sound movies furnished by the *American Airlines*—"Sky Way to Mexico" and "Arizona Sunflight."

Southern California

The program of the September meeting of the Southern California Chapter was presented by Mr. T. R. Parkin of the Naval Ordnance Test Station. It consisted of films showing the activities of the Station and discussion of the problems of measuring the ballistics of rockets and other missiles.

-30-

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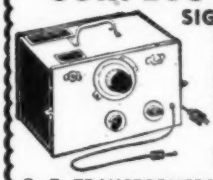

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By DAVID SCOTT

126. What are the actual physical forms of the inductive and capacitive elements in a vestigial sideband filter?

A. *The actual physical form of these elements is sections of coaxial cable. Lengths shorter than a quarter-wavelength present a capacitive reactance, and lengths longer than a quarter-wavelength present an inductive reactance.*

127. How is the audio portion of the television signal transmitted?

A. *The audio signal is transmitted through the process of frequency modulation at a frequency .25 mc. lower than the upper limit of the entire channel and is 50 kc. in bandwidth.*

128. Why is plate modulation not used in television?

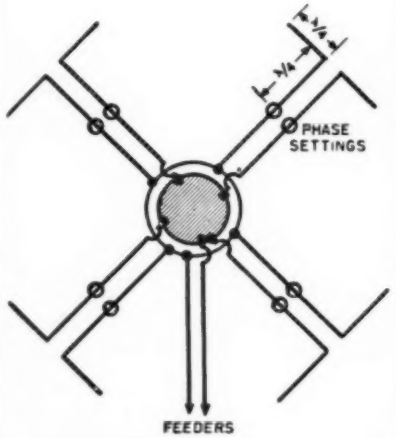
A. *Plate modulation is not used in television because of the very large signal voltage that would be necessary.*

129. Explain the action of a turnstile antenna.

A. *In a turnstile antenna, the outer element of a coaxial radiator should have the form of a curved collar from which protrudes the inner conductor which has an ellipsoid shape. The four collar-ellipsoid combinations are fed inphase quadrature. The sound antenna is of the folded dipole type, has a much narrower impedance characteristic, and displays virtually zero mutual impedance with the video antenna so that the sound and video radiators do not transfer energy from one to the other.*

130. Show how four pairs of dipole antennas may be arranged with a coaxial transmission line.

A.



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1A4P	1.40	5Y4G	.54
1A5GT	.65	5Z3	.65
1A6	1.15	5Z4	.96
1A7GT	.72	6A3	.96
1B4P	1.40	6A4/LA	1.15
1B5/25S	1.15	6A6	.96
1C5GT	.80	6A7	.72
1C6	1.15	6A8GT	.72
1C7	1.15	6AB7	1.15
1D5GP	1.40	6AC7	.96
1D7G	1.15	6AD7G	1.15
1D8GP	1.40	6AF6G	.96
1E5GP	1.40	6AG5	.96
1E7GT	1.40	6AG7	1.15
1F4	.96	6AK5	1.25
1F5G	.96	6AL5	.80
1G4	.96	6AL7	.96
1G6GT	.96	6AQ5	.72
1H4G	.80	6AQ7	.80
1H5GT	.60	6AT6	.54
1H6G	1.15	6AU6	.72
1J6G	.96	6BA6	.65
1L4	.72	6BE6	.65
1LA4	.96	6B4G	.96
1LA6	.96	6B7	1.15
1LB4	.96	6B8G	1.15
1LC5	.96	6C4	.60
1LD5	.96	6C5	.60
1LG5	.96	6C6	.72
1LE3	.96	6C8G	1.15
1LH4	.96	6D6	.60
1LN5	.96	6E5	.80
1N5GT	.72	6F5GT	.60
1P5GT	.80	6F6	.72
1Q5GT	.96	6F6G	.60
1R4	.96	6F7	1.15
1R5	.72	6F8G	1.15
1S4	.85	6G6G	.96
1S5	.65	6H6GT	.60
1T4	.72	6J5GT	.54
1T5GT	.96	6J6	.96
1V	.80	6J7	.72
2A3	1.15	6K6GT	.54
2A4G	1.15	6K7	.60
2A5	.80	6K8	.85
2A6	.96	6L5G	.96
2B7	.96	6L6	1.25
2X2	1.15	6L6GA	1.15
3A4	.72	6L7	1.15
3A8	1.75	6N7	.85
3Q4	.80	6P5GT	.80
3Q5GT	.85	6Q7	.72
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5U4G	.54	6S8GT	$0.85
		6SA7GT	.60
		6SC7	.72
		6SD7GT	1.15
		6SF5	.72
		6SF7	.72
		6SG7	.72
		6SH7	.60
		6SJ7	.60
		6SK7GT	.80
		6SL7GT	.85
		6SN7GT	.80
		6SQ7	.60
		6SR7	.65
		6SS7	.65
		6ST7	.96
		6SV7	1.15
		6T7G	1.15
		6U5	.72
		6U8	.85
		6U7	.65
		6V6	1.15
		6V6GT	.72
		6V7G	$0.96
		6W7G	.96
		6X5GT	.54
		6Y6G	.85
		6Y7G	1.15
		6Z7G	1.40
		6ZY5G	.80
		7A4	.72
		7A5	.72
		7A6	.72
		7A7	.72
		7A8	.72
		7B4	.72
		7B5	.72
		7B6	.72
		7B7	.72
		7B8	.72
		7C5	.72
		7C6	.72
		7C7	.72
		7E6	.72
		7E7	.80
		7F7	.80
		7F8	.90
		7G7	.96
		7H7	.72
		7J7	.96
		7L7	$0.80
		7N7	.80
		7Q7	.72
		7V7	.96
		7W7	.96
		7X7 (XXFM)	.96
		7Y4	.72
		7Z4	.72
		10	1.40
		12A	.65
		12A5	1.15
		12A6	.96
		12A7	1.15
		12A8	.72
		12AH7GT	1.15
		12AT6	.80
		12BA6	.65
		12BE6	.65
		12C8	1.15
		12H6	.65
		12J5GT	.54
		12J7GT	.72
		12K7GT	.80
		12K8	.65
		12Q7GT	.65
		12SA7GT	.65
		12SC7	.80
		12SF5	.65
		12SF7	.72
		12SG7	.72
		12SH7	.80
		12SJ7	.60
		12SK7GT	.60
		12SL7GT	.85
		12SN7GT	.80
		12SQ7GT	.60
		12SR7	.80
		12Z3	.90
		12Z5 (6Z5)	1.15
		14A4	.90
		14A7	.80
		14B6	.80
		14C7	.80
		14F7	.80
		14H7	.80
		14J7	.96
		14N7	.96
		14Q7	.80
		14R7	.80
		14W7	.96
		19	1.40
		24A	.80
		25L6GT	.60
		25Z5	.54
		25Z6GT	.60
		26	.65
		27	.54
		30	.72
		31	$0.96
		32	1.15
		32L7GT	1.15
		33	1.15
		34	1.15
		35	.72
		35A5	.72
		35B5	.72
		35L6GT	.66
		35W4	.45
		35Y4	.65
		35Z4GT	.54
		35Z5GT	.45
		36	.96
		37	.65
		38	.80
		39/44	.96
		40	.80
		41	.60
		42	.60
		43	.60
		45	.60
		45Z3	.65
		45Z5GT	.65
		46	.96
		47	.85
		48	1.40
		50	1.40
		50A5	.80
		50B5	.72
		50L6GT	.66
		50X6	.80
		50Y6GT	.65
		53	.96
		56	.65
		57	.72
		58	.72
		70L7GT	1.40
		71A	.72
		75	.60
		76	.60
		77	.60
		78	.60
		79	.96
		80	.45
		81	1.40
		82	.96
		83	.96
		83V	1.15
		84/6Z4	.65
		85	.80
		89	.80
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		117N7GT	1.40
		117P7	1.40
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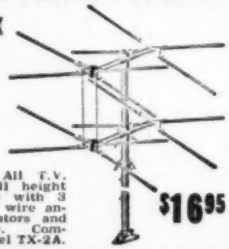

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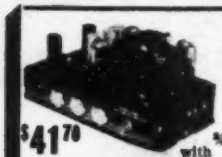

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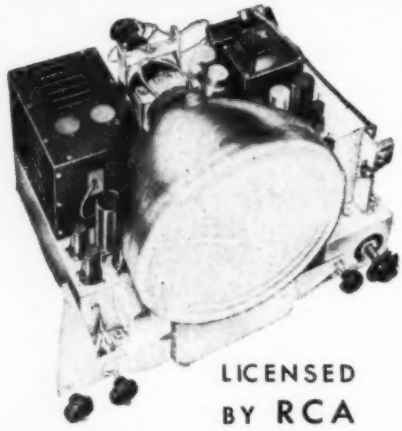

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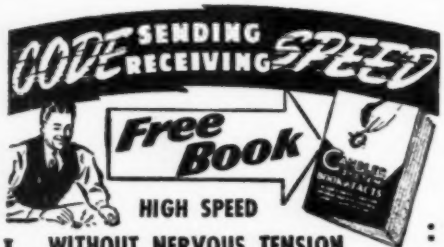

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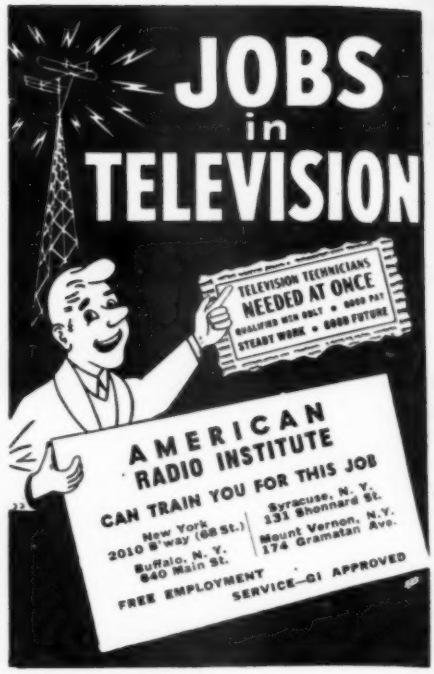

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Do You Know? (Scott)..... 76 July
Do You Know? (Scott)..... 72 Sept.
Do You Know? (Scott)..... 78 Sept.
Do You Know? (Scott)..... 94 Nov.
Do You Know? (Scott).....151 Dec.

TEST EQUIPMENT

A Cathode Follower V.T.V.M. (Schultz) ..... 52 Aug.
A Compact Home-Built Stroboscope (Greenlee) ..... 44 Mar.
A Dual-Purpose Frequency Meter—V.F.O. (Countryman, W3HH, W1-RVK) .....56 May
An Electronic Volt-Ohmmeter (Flaherty) ..... 59 Mar.
A 19-28 mc. Signal Generator for TV I.F. Alignment (Donaldson)..... 52 Feb.
An Inexpensive Audio Frequency Generator (Whitaker, W2BFB).... 40 Aug.
A Novel Plate-Dip Oscillator (Schultz, W2MUU) ..... 42 May
A Pocket Signal Tracer (Barber).... 50 Sept.
A Precision FM Sweep Generator (Carpenter & Shepherd, Jr.)..... 52 Jan.
A Signal Tracer at Minimum Cost (Ward) ..... 49 Oct.
A Simple Distortion Analyzer (Wolfe) 44 Nov.
A Special Wide-Band Scope Amplifier (Kaufman) ..... 74 Oct.
A TV Antenna Location-and-Orientation Indicator (Marco) ..... 68 May
Audio Test Instruments (Fidelman).. 72 Nov.
Build This Absorption Type Signal Marker (Dexter) ..... 54 June
Build This Compact Signal Injector (Turner, K6AI) ..... 40 Apr.
Converted Home Receiver Ideal for Signal Tracer (Fristik)..... 60 Feb.
Recording Stationary CRT Patterns (Hesse) ..... 62 Dec.
Save Testing Time With an "Outlet Box" Unit (Leeper)..... 86 July
The Tubeless Grid-Dip Adapter (Carpenter) ..... 60 May
Versatile R.F. Meter for Ham Stations (Lewes, W8MQU) ..... 35 Apr.
Wide Range Amplifier Increases Sensitivity of V.T. Voltmeter (Turner, K6AI) ..... 78 Mar.
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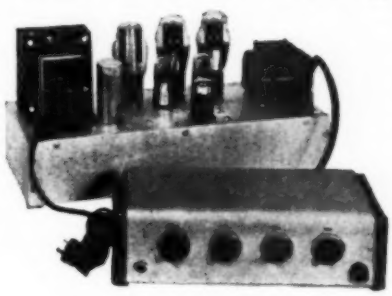

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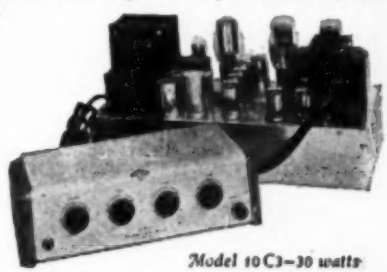

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It is hoped that other individuals and clubs will also contact their local broadcasting stations to present this very worthwhile and constructive program idea. It would, in a large measure, contribute to the prestige of the American Radio Amateur. —30—

ERRATUM

In the article "Audio Service and Development Technique" appearing in the October, 1949 issue of the magazine an error appears on page 72. In the second paragraph of the third column the text should indicate that a 180 degree phase shift would give a straight line rather than a circle. A 90 degree shift would give the circular pattern.

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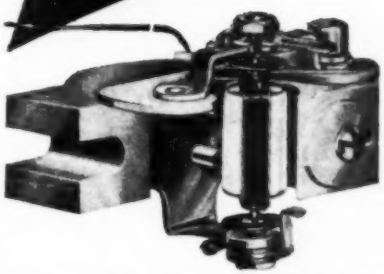

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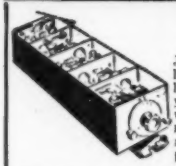

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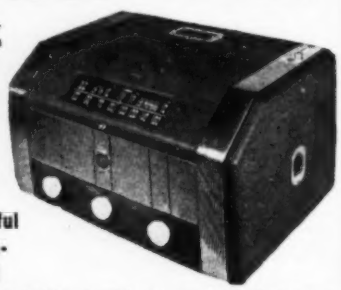

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Recording CRT Patterns

(*Continued from page* 63)

source and diffusing glass turns it into an acceptable enlarger. These uses were contemplated during the design.

An exploded view, Fig. 4, shows the camera, the auxiliary lens mounted in an adaptor ring, the supporting bracket, the three screws for holding the bracket to the panel, the ground glass holder, and the screw and cup for holding the camera to the bracket. A composite view of the arrangement used to produce Fig. 3E is shown in Fig. 1.

No dimensions are given for constructing the camera described since they would be different for other lenses and photograph sizes. It should be quite easy to predict the performance of equipment at hand from the material presented. Or, if it is desired to build a camera for this type of work, a simple procedure can be followed. The first step is to decide on the size of photograph desired and obtain a lens and shutter. The normal lens used in this camera is an old *f*8 rapid rectilinear purchased at a second-hand store. A plano-convex projector lens with a strength of ten diopters is used as the auxiliary, since it could be fitted into a standard *Kodak* adaptor ring. The next step is to mount the lens in any convenient manner and orient it in front of the tube in a darkened room to produce the desired image on a piece of white paper. The necessary dimensions for construction are then available.

The construction of a camera for this type of work is a very interesting project. Much more interesting, however, is the increased utility from a scope when stationary patterns can be recorded with the assurance that each record will be a perfect reproduction of the trace. —30—

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25 TUBES PLUS 4 RECTIFIERS

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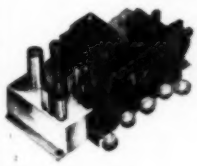
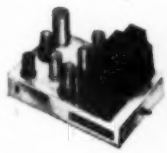


RC-8 FM-AM tuner features automatic frequency control—revolutionary FM development that *entirely eliminates* drift, simplifies tuning.

HI-FI AMPLIFIER



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C.D. TYPE	.035	1000 V.	6c
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Equal to FL-8. Makes neater installation. Used but clean. Both. **95c**
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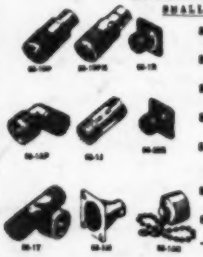

SMALL SINGLE CONTACT CONNECTORS

83-1SP	STRAIGHT PLUG- With molded low-loss mica filled insert	$0.40
83-1SPN	3 PIECE PLUG- TAPERED BACK SHELL FOR .405" O.D. cables	.40
83-1T	"T" CONNECTOR for 83-1R	.40
83-1R	Factory wired RECEPTACLE CHASSIS OR BOX TYPE- Low-loss mica insert	1.50
83-1RTY	RECEPTACLE CHASSIS OR BOX TYPE- Polystyrene & mica insert	.40
83-1AP	ANGLE PLUG ADAPTER- Polystyrene insert- pin & socket	.45
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		.75

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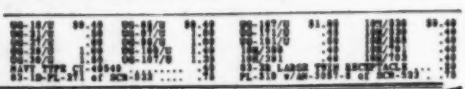
83-1AC	CAP- For connectors 83-1R, 83-1RTY, 83-22R, etc.	.40
83-1T5/U	ADAPTER- For adapting 83-1SP to accommodate RG-58/U	.20
83-1T6/U	ADAPTER- For adapting 83-1SP to accommodate RG 59/U-	.20
10M/1779	CABLE CLAMP M-297 for use with British Connectors	.15

MISCELLANEOUS CONNECTORS



COAX AND TWINAX CABLES

AN NO.	NOMINAL IMPEDANCE OHMS	INNER SHIELD	JACKET MATERIAL	MAX. O.D.	SPECIAL INFORMATION	PRICE PER FT NET
RG-1/U	97.5	COPPER	BLACK VINYL	.370		$0.04
RG-8/U	51	SILVER	GRAY VINYL	.420		.13
RG-10/U	52	COPPER	" "	.475	Armored	.07
RG-17/U	52	"	" "	.870	Sh.Lgth	.40
RG-18/U	52	"	" "	.945	Armored	.40
RG-21/U	53	SILVER	" "	.332		.14
RG-35/U	47.1	COPPER	BLACK RUBBER	.500		.08
RG-55/U	47.1	"	COTTON	.475		.07
RG-58/U	48	"	BLACK RUBBER	.320	Armored	.11
RG-57/U	47	"	" "	.675	Armored	.11
RG-58/U	48	"	POLYETHYLENE	.200		.08
RG-59/U	93.5	"	"	.184		.035
RG-59/U	93.5	"	"	.184		.03
RG-62/U	93	"	"	.242		.04
RG-71/U	185	"	"	.405		.07
RG-74/U	93	"	"	.405		.07
RG-77/U	70	"	"	.242		.04
RG-78/U	52	"	"	.405		.07
RG-83/U	35	"	"	.405		.07
RG-84/U	52	"	"	.405		.07
RG-85/U	52	"	"	.405		.07
RG-87/U	53	"	"	.405		.07
RG-88/U	53	"	"	.405		.07
RG-91/U	75	"	"	.405		.07
RG-92/U	185	"	"	.405		.07
RG-93/U	135	"	"	.405		.07
RG-94/U	53	"	"	.405		.07
RG-95/U	53.5	"	"	.405		.07
RG-96/U	93	"	"	.405		.07
RG-97/U	93	"	BLACK VINYL	.639	2 Cond.	.18
RG-74/U	53	"	GRAY "	.615	Armored	.18
RG-75/U	53	"	POLYETHYLENE	.184		.05
RG-76/U	72	"	"	.343	Sh.Lgth	.08
LOW-LOSS BRAIDED COAXIAL CABLES						
71/13	72	COPPER	BLACK VINYL	.480		.09
72-13R	72	"	" "	.480	60' Coils Only	.08

NOTE THE FOLLOWING LIST OF SPECIAL OFFERINGS

RG-7/U This material is on the original manufacturers reels ranging from 2000 ft. upward..$37.50/M
100 foot coils ..... .04/ft.

RG-20/U This material is on reels of 2000 feet or more $27.50/M
100 foot coils ..... .035/ft.

6-20/U Same as above except with cotton braid covering $35.00/M
100 foot coils ..... .03/ft.

TRANSMITTING MICA CONDENSERS

Manufacturers' Legend: 1-Aerovox; 2-Cornell Dubilier; 3-Faradon; 4-General Electric; 5-Illinois; 6-Micamold; 7-Sangamo; 8-Solar; 9-Sprague

STYLE "AA" CONDENSERS

Cap. Mfd.	Wkg. Volts	Mfr. Leg.	Price Each
.02	3000	2	$4.50
.04	1000	2,7	3.50

STYLE "A" CONDENSERS

Cap. Mfd.	Wkg. Volts	Mfr. Leg.	Price Each
25mmfd	4000	9	$1.05

STYLE "B" CONDENSERS

Cap. Mfd.	Wkg. Volts	Mfr. Leg.	Price Each
.00003	2000	2	$0.70
.00005	2000	2	.70
.0001	3000	4,9	.75
.00025	2500	9	.80
.0005	2500	44 Co.	.70
.00067	1400	9	.75
.0007	2000	7,8	.75
.0009	2500	2,7,9	.75
.001	3000	7	.80
.00125	3000	7	.80
.0015	4000	2,7,9	.85
.0016	4000	7	.90
.002	3000	2,7	.90
.0025	3000	7	.95
.003	3000	7	.95
.0035	3000	7	.95
.004	3000	2,7,9	1.00
.005	3000	7	1.00
.0055	3000	7	1.00
.006	3000	7	1.00
.0065	3000	7	1.00
.007	3000	7	1.00
.0075	3000	7	1.00
.008	3000	7	1.00
.009	3000	7	1.00
.01	3000	7	1.00
.0125	4000	7	1.10
.015	3000	7	1.10
.0175	4000	7	1.10
.02	3000	7	1.10
.025	3000	7	1.15
.03	3000	7	1.15
.035	3000	7	1.15
.04	3000	7	1.15
.045	3000	7	1.20
.05	3000	7	1.20
.06	3000	7	1.20
.07	3000	7	1.20
.08	3000	7	1.20
.09	3000	7	1.20
.1	3000	7	1.20
.15	3000	7	1.20
.2	3000	7	1.20
.25	3000	7	1.20
.3	3000	7	1.20
.4	3000	7	1.20
.5	3000	7	1.20
.6	3000	7	1.20
.7	3000	7	1.20
.8	3000	7	1.20
.9	3000	7	1.20
1.0	3000	7	1.20

STYLE "C" CONDENSERS

Cap. Mfd.	Wkg. Volts	Mfr. Leg.	Price Each
.00045	2500	4	$0.40
.0005	600	7,8	.30
.001	600	2,7	.30
.001	1200	7	.30
.0015	2500	4,7,8	.30
.0022	400	2,7,9	.25
.0025	2500	4	.40
.0033	2500	4	.40
.0035	2500	7,8	.40
.0045	2500	4	.40
.005	2500	9	.40
.0056	2500	7	.40
.0066	2500	7,9	.40
.0075	2500	7	.40
.0085	2500	7	.40
.009	2500	7	.40
.0095	2500	7	.40
.01	600	9	.35
.01	1200	2,7,8	.40
.01	2500	4	.40
.01	3750	7	.45
.0115	600	9	.40
.0115	1500	9	.40
.012	600	7	.35
.012	2500	1,2,8	.40
.012	1200	2	.40
.0125	2500	1,2,9	.40
.013	2500	9	.40
.014	2500	7,9	.40
.0145	2500	9	.40
.015	600	9	.40
.015	1200	2,7,9	.40
.015	2500	4	.40
.015	3750	7	.45
.016	2500	7,9	.40
.017	2500	7	.40
.018	2500	7	.40
.018	3750	7	.45
.019	2500	7	.40
.02	600	9	.40
.02	1200	2,7,8	.40
.02	2500	4	.40
.02	3750	7	.45
.021	2500	7	.40
.022	2500	7	.40
.022	3750	7	.45
.023	2500	7	.40
.024	2500	7	.40
.025	600	9	.40
.025	1200	2,7,9	.40
.025	2500	4	.40
.025	3750	7	.45
.027	2500	7	.40
.03	600	9	.40
.03	1200	2,7,8	.40
.03	2500	4	.40
.03	3750	7	.45
.033	600	9	.40
.033	1200	2,7,9	.40
.033	2500	4	.40
.033	3750	7	.45
.035	2500	7	.40
.036	2500	7	.40
.039	2500	7	.40
.04	600	9	.40
.04	1200	2,7,8	.40
.04	2500	4	.40
.04	3750	7	.45
.045	600	9	.40
.045	1200	2,7,9	.40
.045	2500	4	.40
.045	3750	7	.45
.047	600	9	.40
.047	1200	2,7,8	.40
.047	2500	4	.40
.047	3750	7	.45
.05	600	9	.40
.05	1200	2,7,9	.40
.05	2500	4	.40
.05	3750	7	.45
.056	600	9	.40
.056	1200	2,7,8	.40
.056	2500	4	.40
.056	3750	7	.45
.06	600	9	.40
.06	1200	2,7,9	.40
.06	2500	4	.40
.06	3750	7	.45
.065	600	9	.40
.065	1200	2,7,8	.40
.065	2500	4	.40
.065	3750	7	.45
.068	600	9	.40
.068	1200	2,7,9	.40
.068	2500	4	.40
.068	3750	7	.45
.07	600	9	.40
.07	1200	2,7,8	.40
.07	2500	4	.40
.07	3750	7	.45
.075	600	9	.40
.075	1200	2,7,9	.40
.075	2500	4	.40
.075	3750	7	.45
.08	600	9	.40
.08	1200	2,7,8	.40
.08	2500	4	.40
.08	3750	7	.45
.085	600	9	.40
.085	1200	2,7,9	.40
.085	2500	4	.40
.085	3750	7	.45
.09	600	9	.40
.09	1200	2,7,8	.40
.09	2500	4	.40
.09	3750	7	.45
.095	600	9	.40
.095	1200	2,7,9	.40
.095	2500	4	.40
.095	3750	7	.45
.1	600	9	.40
.1	1200	2,7,8	.40
.1	2500	4	.40
.1	3750	7	.45
.11	600	9	.40
.11	1200	2,7,9	.40
.11	2500	4	.40
.11	3750	7	.45
.12	600	9	.40
.12	1200	2,7,8	.40
.12	2500	4	.40
.12	3750	7	.45
.13	600	9	.40
.13	1200	2,7,9	.40
.13	2500	4	.40
.13	3750	7	.45
.14	600	9	.40
.14	1200	2,7,8	.40
.14	2500	4	.40
.14	3750	7	.45
.15	600	9	.40
.15	1200	2,7,9	.40
.15	2500	4	.40
.15	3750	7	.45
.16	600	9	.40
.16	1200	2,7,8	.40
.16	2500	4	.40
.16	3750	7	.45
.17	600	9	.40
.17	1200	2,7,9	.40
.17	2500	4	.40
.17	3750	7	.45
.18	600	9	.40
.18	1200	2,7,8	.40
.18	2500	4	.40
.18	3750	7	.45
.19	600	9	.40
.19	1200	2,7,9	.40
.19	2500	4	.40
.19	3750	7	.45
.2	600	9	.40
.2	1200	2,7,8	.40
.2	2500	4	.40
.2	3750	7	.45
.21	600	9	.40
.21	1200	2,7,9	.40
.21	2500	4	.40
.21	3750	7	.45
.22	600	9	.40
.22	1200	2,7,8	.40
.22	2500	4	.40
.22	3750	7	.45
.23	600	9	.40
.23	1200	2,7,9	.40
.23	2500	4	.40
.23	3750	7	.45
.24	600	9	.40
.24	1200	2,7,8	.40
.24	2500	4	.40
.24	3750	7	.45
.25	600	9	.40
.25	1200	2,7,9	.40
.25	2500	4	.40
.25	3750	7	.45

STYLE "D" CONDENSERS

Cap. Mfd.	Wkg. Volts	Mfr. Leg.	Price Each
.00025	1200	7	$0.35
.0004	600	7	.30
.0005	600	2,8	.30
.0005	1200	7,9	.30
.00067	2500	2,8,9	.30
.001	600	9	.30
.001	1200	7,8	.30
.001	2500	7	.30
.0015	600	9	.30
.0015	2500	2,8	.30
.002	600	9	.30
.002	1200	7,8	.30
.002	2500	7	.30
.0025	600	9	.30
.0025	1200	7,8,9	.30
.0025	2500	7	.30
.003	600	9	.30
.003	1200	7,8	.30
.003	2500	7	.30
.0035	600	9	.30
.0035	1200	7,8	.30
.0035	2500	7	.30
.004	600	9	.30
.004	1200	7,8	.30
.004	2500	7	.30
.0045	600	9	.30
.0045	1200	7,8	.30
.0045	2500	7	.30
.005	600	9	.30
.005	1200	7,8	.30
.005	2500	7	.30
.0055	600	9	.30
.0055	1200	7,8	.30
.0055	2500	7	.30
.006	600	9	.30
.006	1200	7,8	.30
.006	2500	7	.30
.0065	600	9	.30
.0065	1200	7,8	.30
.0065	2500	7	.30
.007	600	9	.30
.007	1200	7,8	.30
.007	2500	7	.30
.0075	600	9	.30
.0075	1200	7,8	.30
.0075	2500	7	.30
.008	600	9	.30
.008	1200	7,8	.30
.008	2500	7	.30
.009	600	9	.30
.009	1200	7,8	.30
.009	2500	7	.30
.01	600	9	.30
.01	1200	7,8	.30
.01	2500	7	.30
.011	600	9	.30
.011	1200	7,8	.30
.011	2500	7	.30
.012	600	9	.30
.012	1200	7,8	.30
.012	2500	7	.30
.013	600	9	.30
.013	1200	7,8	.30
.013	2500	7	.30
.014	600	9	.30
.014	1200	7,8	.30
.014	2500	7	.30
.015	600	9	.30
.015	1200	7,8	.30
.015	2500	7	.30
.016	600	9	.30
.016	1200	7,8	.30
.016	2500	7	.30
.017	600	9	.30
.017	1200	7,8	.30
.017	2500	7	.30
.018	600	9	.30
.018	1200	7,8	.30
.018	2500	7	.30
.019	600	9	.30
.019	1200	7,8	.30
.019	2500	7	.30
.02	600	9	.30
.02	1200	7,8	.30
.02	2500	7	.30
.021	600	9	.30
.021	1200	7,8	.30
.021	2500	7	.30
.022	600	9	.30
.022	1200	7,8	.30
.022	2500	7	.30
.023	600	9	.30
.023	1200	7,8	.30
.023	2500	7	.30
.024	600	9	.30
.024	1200	7,8	.30
.024	2500	7	.30
.025	600	9	.30
.025	1200	7,8	.30
.025	2500	7	.30
.026	600	9	.30
.026	1200	7,8	.30
.026	2500	7	.30
.027	600	9	.30
.027	1200	7,8	.30
.027	2500	7	.30
.028	600	9	.30
.028	1200	7,8	.30
.028	2500	7	.30
.029	600	9	.30
.029	1200	7,8	.30
.029	2500	7	.30
.03	600	9	.30
.03	1200	7,8	.30
.03	2500	7	.30
.031	600	9	.30
.031	1200	7,8	.30
.031	2500	7	.30
.032	600	9	.30
.032	1200	7,8	.30
.032	2500	7	.30
.033	600	9	.30
.033	1200	7,8	.30
.033	2500	7	.30
.034	600	9	.30
.034	1200	7,8	.30
.034	2500	7	.30
.035	600	9	.30
.035	1200	7,8	.30
.035	2500	7	.30
.036	600	9	.30
.036	1200	7,8	.30
.036	2500	7	.30
.037	600	9	.30
.037	1200	7,8	.30
.037	2500	7	.30
.038	600	9	.30
.038	1200	7,8	.30
.038	2500	7	.30
.039	600	9	.30
.039	1200	7,8	.30
.039	2500	7	.30
.04	600	9	.30
.04	1200	7,8	.30
.04	2500	7	.30
.041	600	9	.30
.041	1200	7,8	.30
.041	2500	7	.30
.042	600	9	.30
.042	1200	7,8	.30
.042	2500	7	.30
.043	600	9	.30
.043	1200	7,8	.30
.043	2500	7	.30
.044	600	9	.30
.044	1200	7,8	.30
.044	2500	7	.30
.045	600	9	.30
.045	1200	7,8	.30
.045	2500	7	.30
.046	600	9	.30
.046	1200	7,8	.30
.046	2500	7	.30
.047	600	9	.30
.047	1200	7,8	.30
.047	2500	7	.30
.048	600	9	.30
.048	1200	7,8	.30
.048	2500	7	.30
.049	600	9	.30
.049	1200	7,8	.30
.049	2500	7	.30
.05	600	9	.30
.05	1200	7,8	.30
.05	2500	7	.30
.051	600	9	.30
.051	1200	7,8	.30
.051	2500	7	.30
.052	600	9	.30
.052	1200	7,8	.30
.052	2500	7	.30
.053	600	9	.30
.053	1200	7,8	.30
.053	2500	7	.30
.054	600	9	.30
.054	1200	7,8	.30
.054	2500	7	.30
.055	600	9	.30
.055	1200	7,8	.30
.055	2500	7	.30
.056	600	9	.30
.056	1200	7,8	.30
.056	2500	7	.30
.057	600	9	.30
.057	1200	7,8	.30
.057	2500	7	.30
.058	600	9	.30
.058	1200	7,8	.30
.058	2500	7	.30
.059	600	9	.30
.059	1200	7,8	.30
.059	2500	7	.30
.06	600	9	.30
.06	1200	7,8	.30
.06	2500	7	.30
.061	600	9	.30
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.061	2500	7	.30
.062	600	9	.30
.062	1200	7,8	.30
.062	2500	7	.30
.063	600	9	.30
.063	1200	7,8	.30
.063	2500	7	.30
.064	600	9	.30
.064	1200	7,8	.30
.064	2500	7	.30
.065	600	9	.30
.065	1200	7,8	.30
.065	2500	7	.30
.066	600	9	.30
.066	1200	7,8	.30
.066	2500	7	.30
.067	600	9	.30
.067	1200	7,8	.30
.067	2500	7	.30
.068	600	9	.30
.068	1200	7,8	.30
.068	2500	7	.30
.069	600	9	.30
.069	1200	7,8	.30
.069	2500	7	.30
.07	600	9	.30
.07	1200	7,8	.30
.07	2500	7	.30
.071	600	9	.30
.071	1200	7,8	.30
.071	2500	7	.30
.072	600	9	.30
.072	1200	7,8	.30
.072	2500	7	.30
.073	600	9	.30
.073	1200	7,8	.30
.073	2500	7	.30
.074	600	9	.30
.074	1200	7,8	.30
.074	2500	7	.30
.075	600	9	.30
.075	1200	7,8	.30
.075	2500	7	.30

STYLE "E" CONDENSERS

Cap. Mfd.	Wkg. Volts	Mfr. Leg.	Price Each
.0002	5000	2	$0.45
.0003	2500	2	.40
.00075	1500	2	.35
.001	1500	2,7	.35
.002	1500	7	.35
.003	1500	7	.35
.004	1500	7	.35
.005	1500	7	.35
.006	1500	7	.35
.007	1500	7	.35
.008	1500	7	.35
.009	1500	7	.35
.01	1500	7	.35
.02	1500	7	.35
.03	1500	7	.35
.04	1500	7	.35
.05	1500	7	.35
.06	1500	7	.35
.07	1500	7	.35
.08	1500	7	.35
.09	1500	7	.35
.1	1500	7	.35
.2	1500	7	.35
.3	1500	7	.35
.4	1500	7	.35
.5	1500	7	.35
.6	1500	7	.35
.7	1500	7	.35
.8	1500	7	.35
.9	1500	7	.35
1.0	1500	7	.35

METAL DRAWN PAPER CAPACITORS

STOCK NO.	CAPACITY MFD.	DCW VOLTS	NO. OF LEADS & LOCATION	FIG.	MANUFACTURER'S NAME & PART NO.	UNIT PRICE
338-14	.05	600	2 SIDE	A	POTTER P-1017	$0.30
347-25	.05	600	1 SIDE	A	POTTER CO-502B	.25
347-30	.05	600	2 SIDE	A	WICAMOLD - SPRAGUE	.35
338-30	.1	200	1 SIDE	A	WICAMOLD	.25
407-10	.1	600	2 TOP	A	BELMONT A-BR-4606	.35
407-26	.1	600	2 SIDE	A	INDUSTRIAL SPRAGUE C.D.	.35
335-7	.1	600	2 SIDE	A	AEROVOX 174170	.35
407-12	.1	1000	2 SIDE	A	INDUSTRIAL	.55
335-9	.2	400	2 TOP	A	SOLAR 170330	.30
338-6	.25	400	2 TOP	A	SPRAGUE 10P-216	.25
347-4	.25	330AC	2 SIDE	C	AEROVOX 25 15-00-2	.35
335-15	.25	330AC	2 SIDE	C	SPRAGUE AEROVOX	.35
335-28	.25	400	2 TOP	A	SOLAR 1H0828	.30
335-31	.25	400	2 SIDE	A	SOLAR 170870	.30
338-2	.25	400	2 SIDE	A	AEROVOX 25 1249-3	.30
407-16	.25	400	1 SIDE	A	AEROVOX	.30
347-3	.25	400	2 SIDE	A	AEROVOX 25 1249-3	.30
440-2	.25	600	2 TOP	A	SPRAGUE 45401	.35
333-41	.25	600	2 TOP	A	C.D. DYRT0025	.35
339-20	.3	400	2 TOP	A	SOLAR 200105	.30
335-04	.35	400	2 BOTTOM	A	WICAMOLD	.35
338-61	.5	180	2 TOP	A	POTTER CD-5043	.25
347-17	.5	200	2 SIDE	A	WICAMOLD 10497	.30
338-11	.5	400	2 SIDE	A	SOLAR 1H-1026-2	.30
347-8	.5	400	2 SIDE	A	BIG. C. TYPE CA-177A	.30
407-19	.5	400	2 SIDE	A	PAINT	.30
407-10	.5	400	2 TOP	A	SPRAGUE SUBMAR5	.30
335-8	.5	600	2 SIDE	A	SOLAR 174171	.35
338-4	.5	600	2 TOP	A	C.D. 177600	.35
338-13	.5	600	2 TOP	A	SOLAR	.35
338-49	.5	600	2 SIDE	A	C.D.	.35
347-14	.5	600	2 BOTTOM	A	C.D. DYRB-6080	.35
333-43	.5	600	2 BOTTOM	A	SPRAGUE 300447-3	.35
407-34	.5	1000	2 TOP	B	GUDEMAN 75 17-YR	.55
335-63	1	400	2 SIDE	B	SPRAGUE	.35
407-14	1	600	2 SIDE	B	WICAMOLD	.45
333-49	1	600	2 SIDE	B	SPRAGUE	.45
407-21	1	600	2 SIDE	B	SPRAGUE WICAMOLD	.45
335-49	1	600	2 END	D	AEROVOX	.45
335-58	1	1000	2 SIDE	B	C.D. DYR1010DS	.55
347-30	1.25	100	2 SIDE	C	ELEC. UTILITIES CO-125	.35
347-21	1.25	100	2 SIDE	C	GUDEMAN 75-225	.35
335-60	2	600	2 BOTTOM	B	SPRAGUE	.40
333-42	2	600	2 SIDE	B	C.D. DYR-6200	.40
335-32	2	50	2 SIDE	B	C.D. SPRAGUE	.35
347-1	4	50	1 SIDE	B	AEROVOX C-60g33	.35
347-27	4	90	2 SIDE	B	C.D. C4-575	.35
407-33	10	25	2 SIDE	A	INDUSTRIAL	.45
407-35	20	50	2 SIDE	A	SPRAGUE	.45
335-45	25	25	2 SIDE	A	AMER. COND. 5068	.40
449-3	25	40	2 BOTTOM	A	CD-2605	.45
347-43	25	50	1 SIDE	A	SPRAGUE D9090	.45
407-13	40	25	2 SIDE	A	WICAMOLD	.40
347-42	50	25	1 TOP	A	C. D. 660308-4	.45
335-40	2 x .1	100	3 SIDE	B	POTTER BR-105027-6	.25
338-60	2 x .1	200	2 BOTTOM	B	CBL-1576	.25
347-7	2 x .1	300	3 SIDE	A	POTTER CP-208	.25
347-9	2 x .1	300	3 TOP	D	SOLAR SJ-382	.30
407-30	2 x .1	600	3 SIDE	A	SPRAGUE PB-6161-1	.35
333-44	2 x .1	600	3 TOP	A	SPRAGUE A-4916	.35
339-35	2 x .1	600	3 TOP	A	C. D.	.40
407-17	2 x .1	600	3 SIDE	A	C. D. - SPRAGUE	.40
407-38	2 x .1	600	3 BOTTOM	B	A

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Anyone Can Build Them!

HIGH-PRECISION VACUUM TUBE VOLTMETER

Model 221-K

$23.95

Tops in work bench versatility. 15 different ranges! AC and DC ranges: 0 5/10 /100/500/1000 volts. Electronic ohmmeter ranges from .2 ohms to 1000 megohms in 5 steps. New features include Zero Center for TV discriminator alignment. DC input impedance is 26 megohms. Exceptionally accurate, big 4½" meter cannot burn out. Double triode balanced bridge circuit assures stable guaranteed performance. Sturdy portable steel case with etched, rubproof panel. 110-130 V. AC 50-60 cycle. Size: 9 5/16"x6"x5".

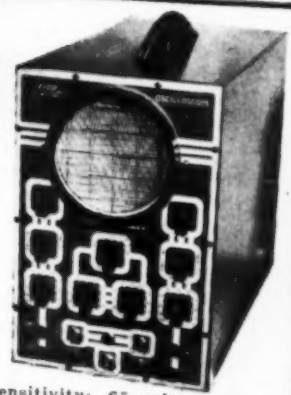
FACTORY-WIRED VTVM

Model 221. Same, but completely wired, calibrated, and tested..... **$49.95**

5" 'SCOPE

Model 400-K

$39.95

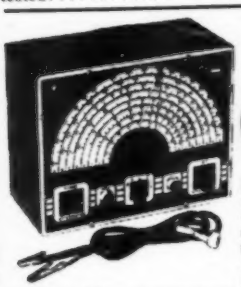


Quality throughout. Laboratory precision scope, for FM, AM, & TV servicing. Deflection sensitivity: .65 volts per inch full gain. Linear sweep with 884 gas triode. Horizontal sweep circuit, 15 to 30,000 cycles. Frequency response of horizontal and vertical amps is from 50 to 50,000 cycles. Provision for external synchronization, test voltage, and intensity modulation. Complete with 2—6SJ7's, 2—5Y3's, 884, and 5BP1 CR tube. Graph screen for measuring peak to peak voltages. Operates on 110 to 130 volts AC, 50-60 cycles. All controls on front of handsome 3-color etched, rub-proof panel. Size: 8½"x17"x13" high. Shpg. wt. 30 lbs. As with all EICO kits, easy-to-follow Pictorial and Schematic diagrams are included.

FACTORY-BUILT OSCILLOSCOPE

Model 400. The same high-quality, life-long instrument, but fully wired, assembled, and tested..... **$69.95**

NEW! MODEL 320-K SIGNAL GENERATOR



$19.95

An excellent instrument for service, lab, and school use. Can be used for FM, AM alignment and to provide TV marker frequencies. Highly stable Hartley oscillator has range of 150 kc to 102 mc with fundamentals to 34 mc. Colpitts audio oscillator supplies **pure 400 cycle sine wave** voltage for modulation. Audio oscillator voltage can be used for testing distortion in audio equipment, bridge measurements, etc. Handsome etched panel with easy-to-read calibrations. Easily assembled and aligned. Complete with tubes.

FACTORY-WIRED AND ALIGNED

Model 320. Ready to use..... **$29.95**

VERSATILE MULTI-SIGNAL TRACER

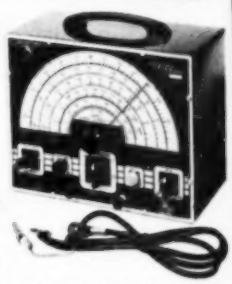
$18.95

Model 145-K. Versatile, high gain—high frequency instrument. Self-contained test speaker permits audible signal tracing of RF, IF, FM, audio, and video circuits. Has provision for visual tracing with VTVM. Response is well over 200 mc 3-color hammertone panel. 110-125 V. AC. Size: 10"x8"x4¾". Comes complete with tubes and diode probe in kit form.

FACTORY-BUILT AND TESTED

Model 145. Ready to operate.. **$28.95**

SEE THE *SENSATIONAL NEW* EICO Model 360-K TV-FM SWEEP SIGNAL GENERATOR



WITH ALL THESE LABORATORY-QUALITY FEATURES: **$29.95**

• Crystal marker oscillator with variable amplitude. • Covers all TV and FM alignment frequencies between 500 kc and 228 mc. • Sweepwidth variable from 0-30 mc, with mechanical inductive sweep. • Extremely wide sweepwidth allows gain comparison of adjacent RF TV Channels. • Provides for injection of external signal generator marker. • Phasing control included. • Vernier driven, calibrated tuning dial for master oscillator. • Large, easy-to-read dial is directly calibrated in frequencies. • Extremely stable oscillator gives clear, steady pattern. • Can be used with EICO Model 400-K or any other standard oscilloscope. • All components furnished, including handsome, lifelong 3-color etched panel, and durable steel cabinet. Comes complete with all tubes (including new, high-frequency miniature types): 6X5GT, 12AU7, two 6C4's. Crystal not included. 10"x8"x6¾".

FACTORY-BUILT AND TESTED

Model 360. Ready to use Sweep Signal Generator..... **$39.95**

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DELUXE SIGNAL GENERATOR

MODEL 315

EICO presents this **completely wired,** ready-to-use Signal Generator with 1% accuracy! A wonderful test instrument with dozens of expensive features. Frequency range: 75 kc to 150 mc. Has microcycle band-spread vernier tuning for FM, AM, and TV. Voltage regulator permits line variations from 95 to 135 V without affecting accuracy. Write for full details. Completely wired and assembled..... **$59.95**

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You can count on Mallory Capacitors for longer shelf life—longer life in an inactive set—lower RF impedance—and ability to withstand higher ripple current.

Mallory Capacitors cost no more than ordinary capacitors—they're easy to install, and when they're installed they're *dependable* . . . and that means the kind of service that satisfies customers. Order from your Mallory distributor.

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